New Vanguard

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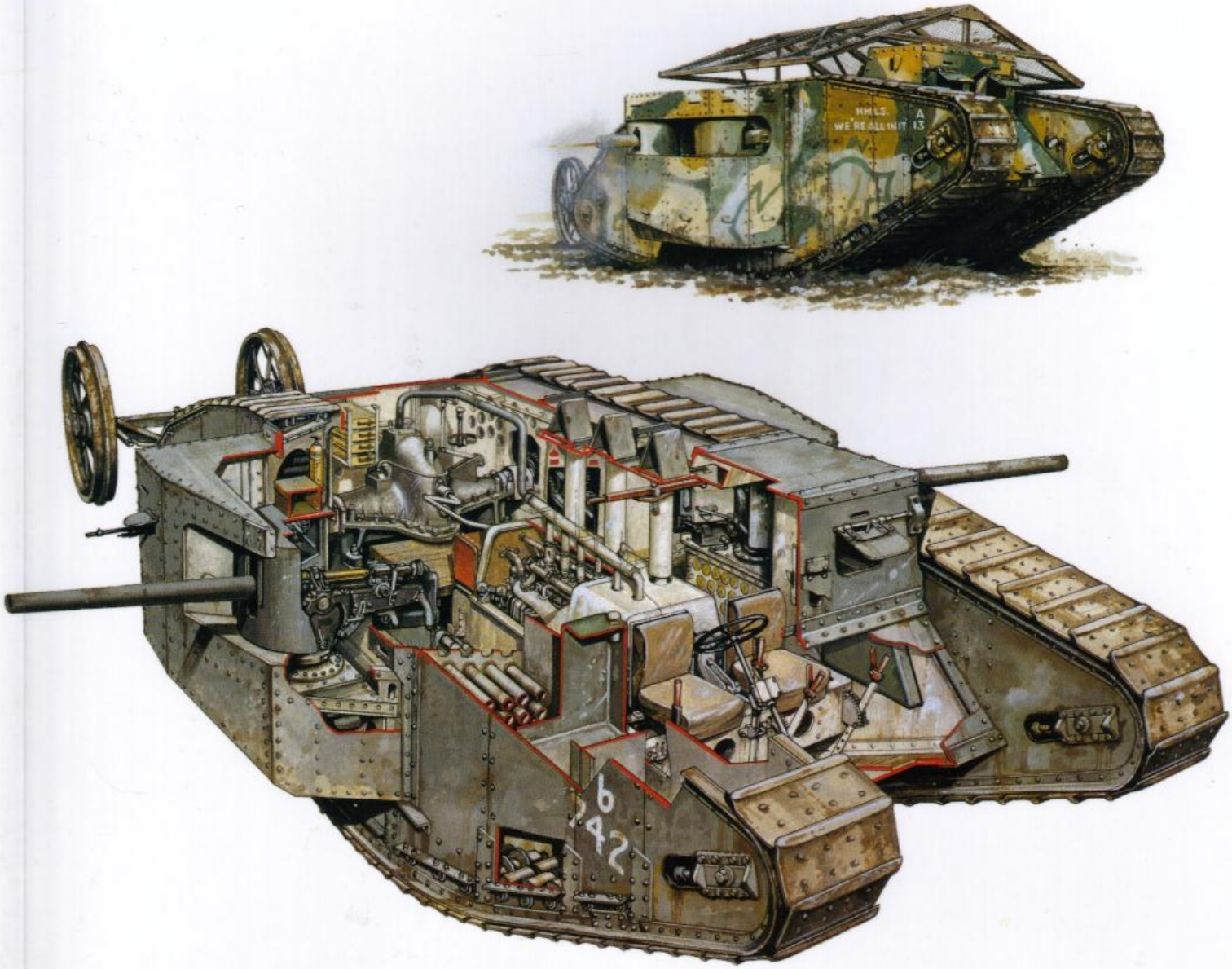
British Mark I Tank 1916



David Fletcher • Illustrated by Tony Bryan

DAVID FLETCHER was born in 1942. He has written a number of books and articles on military subjects and is currently the historian at the Tank Museum, Bovington, UK. He has spent over 40 years studying the development of British armoured vehicles during the two World Wars.

TONY BRYAN is a freelance illustrator of many years experience. He initially qualified in Engineering and worked for a number of years in Military Research and Development, and has a keen interest in military hardware – armour, small arms, aircraft and ships. Tony has produced many illustrations for partworks, magazines and books, including a number of titles in Osprey's New Vanguard series.

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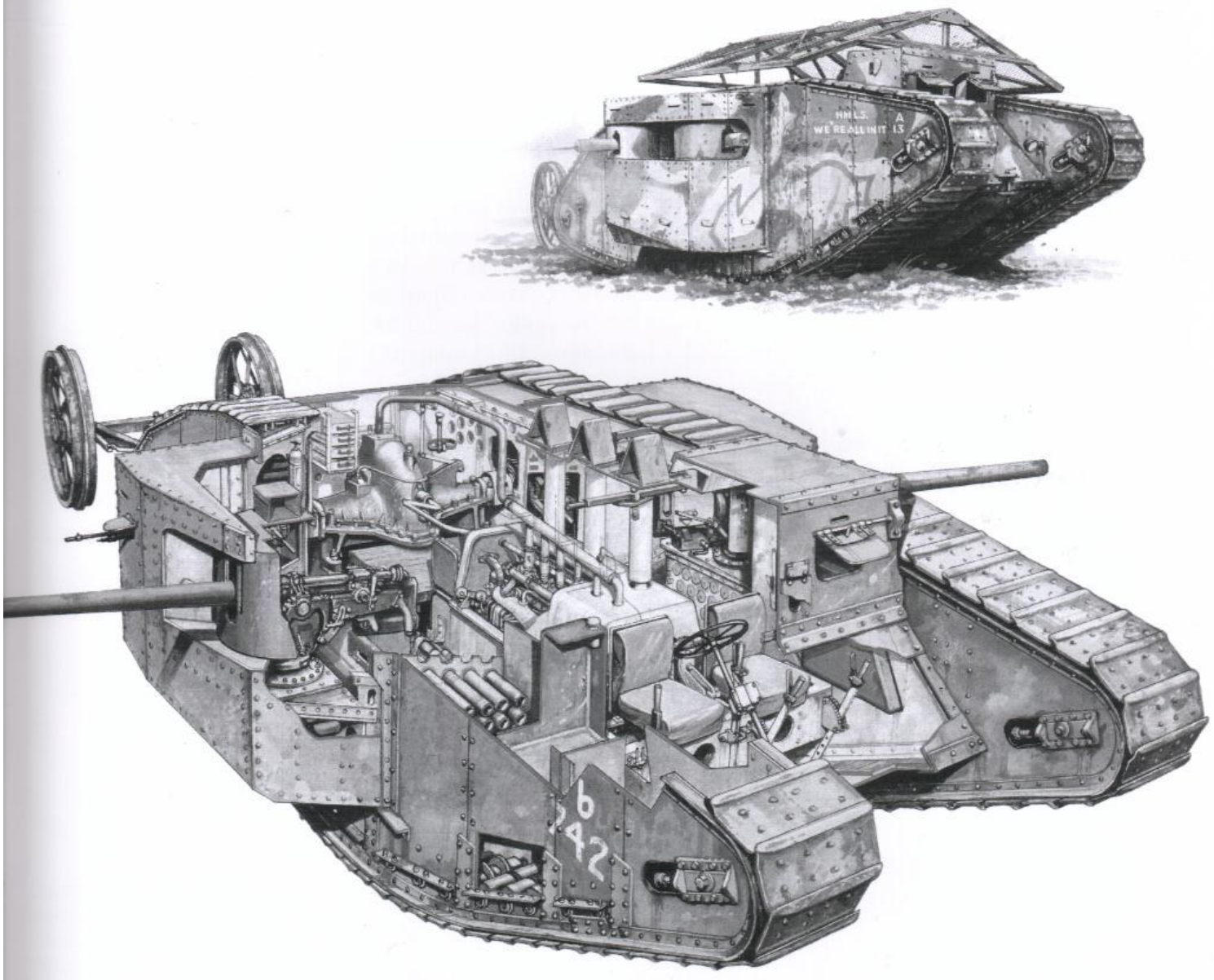

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Tony Bryan, 4a Forest View Drive, Wimborne, Dorset, BH21 7NZ, UK

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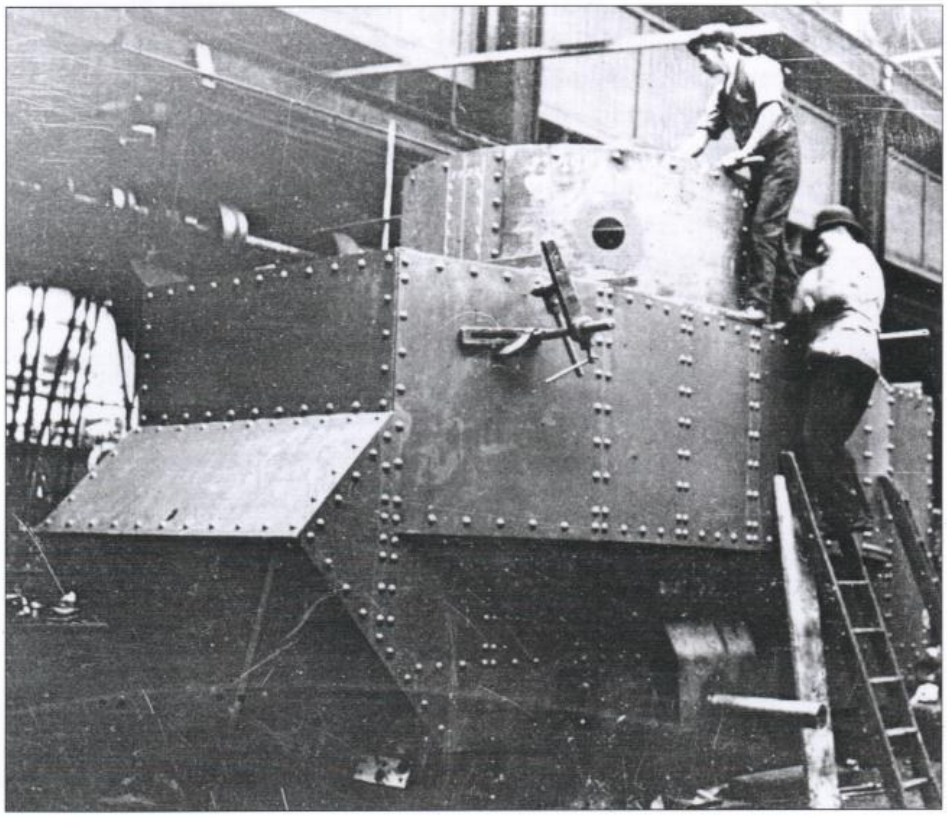
BRITISH MARK I TANK 1916

IN THE BEGINNING

The story of how the tank came to be invented is a long and convoluted one, too long to tell here. In this volume we take as our starting point a time in August 1915 when a set of crawler tracks, manufactured by the Bullock Creeping Grip Tractor Company of Chicago, arrived at Liverpool docks for onward shipment to the city of Lincoln. The project, which would now come to fruition, had begun as an Admiralty scheme, inspired by the First Lord, Winston Churchill, with the creation of the Landships Committee in February 1915.

In fact the shipment from Chicago was not just lengths of track but complete sets of tracks, frames, sprockets and rollers all ready to fit to a design then under construction in England. They were stretched versions of a system that the Bullock Company manufactured for their range of agricultural tractors. Each set comprised a girder frame with a driven sprocket at the back, an adjustable idler wheel at the front and a system of small rollers, on a sub-frame, running along the tracks at the bottom. Additional rollers at the top supported the return run of the tracks. Compared with some other types manufactured in the United States, the



The *Number One Lincoln Machine* takes shape inside Foster's Wellington Foundry. Two fitters are working on the turret. The shaft near the bottom is the pivot upon which a Bullock track unit will be mounted in due course.

Bullocks were not constructed to very high standards and appear to have been entirely devoid of any springs. The track links were formed from single-piece manganese steel castings, about 61cm (24in.) wide on the outer face and joined by pins.

William Tritton, managing director of William Foster & Company of Lincoln, had accepted a contract from the Admiralty for the construction of a prototype landship, which was to be fitted with the imported American tracks. As soon as he saw them Tritton expressed doubts about these tracks, doubts that were shared by his colleague, Walter Wilson. A naval officer with a fascinating engineering background, Wilson had been posted to Lincoln to co-operate with Tritton and oversee the work on behalf of the Admiralty. It was these two men, so unalike in temperament, character and background, who became the formidable team which, within a further six months, adapted a crude concept into a viable prototype for an entirely new weapon system.

The *Number One Lincoln Machine*

Their first effort, known as the *Number One Lincoln Machine*, was completed, up to a point, and moved on its tracks for the first time on 9 September 1915 in the yard of the Foster Company's Wellington Foundry. It comprised a riveted steel body, surmounted by a drum-shaped turret, running on the imported tracks. One early source claims that the turret was not intended to rotate, but if so there would have been no point in making it drum shaped. Maybe this was true of the prototype for purely practical reasons but one imagines that this would have been changed had it gone into production.

The vehicle was powered by a British Daimler engine and entire transmission, derived from the huge Foster-Daimler tractors that Tritton's firm had already built for the Royal Marine Artillery. Trials revealed that the tracks would not work, as Tritton and Wilson had foreseen. Those fitted to the commercial tractors were a good deal shorter so the fact that they lay flat along the ground was not a problem. In this longer form it was a different matter. The extended ground contact meant they would not steer easily so Tritton came up with a modification which he described as a 'fish belly' shape. This involved altering the position of the lower rollers so that

Draped with tarpaulin covers disguise its warlike purpose, *Lincoln Machine* is shown during trials. This photo was taken after the tracks had be modified, but they still proved unsuitable for the work they would have to do.

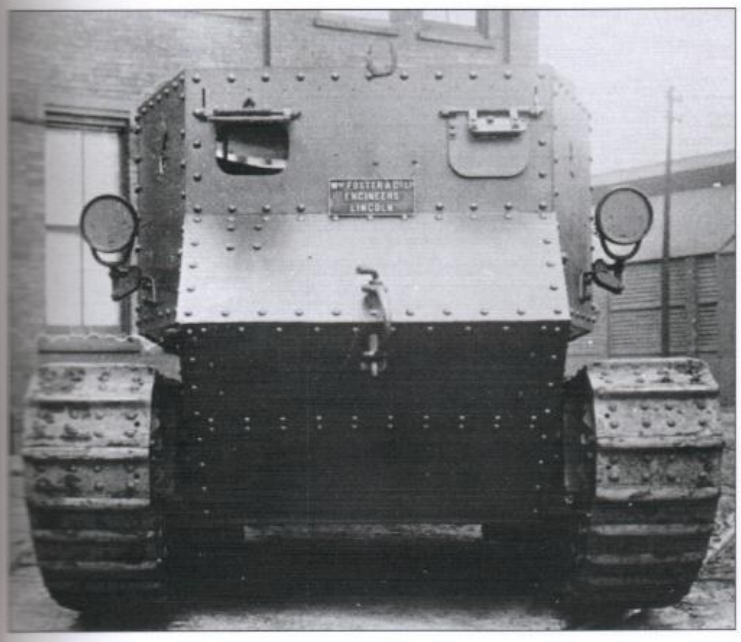
the tracks presented a slightly curved surface to the ground, thus reducing lateral resistance. Even so this only solved one problem; there were still two more. To begin with, the imported tracks were not really robust enough to carry a load in the region of 16 tons and in any case they also showed a tendency to sag away from the track rollers when the machine attempted to cross a trench. As a result, more often than not, they failed to realign themselves on the far side of the trench, bringing the vehicle to a halt in a most awkward location.

Wilson's big idea

Up to this time the project had been exclusively promoted, albeit somewhat reluctantly, by the Admiralty. The War Office had been playing about with similar concepts but to no particular purpose, much to the dismay of one Army officer, Colonel Ernest Swinton. A Royal Engineer, Swinton had been advocating a mechanical solution to the problems of trench warfare since 1914 but he was not getting very far. Sent to observe the new contraption in Lincoln, on behalf of the War Office, he was at once inspired and dismayed; inspired that the project had got so far without his knowing about it but depressed by its poor performance. Sensing this, Tritton and Wilson guided the Army officer towards a locked shed, inside which he was shown a wooden mock-up of Wilson's big idea.

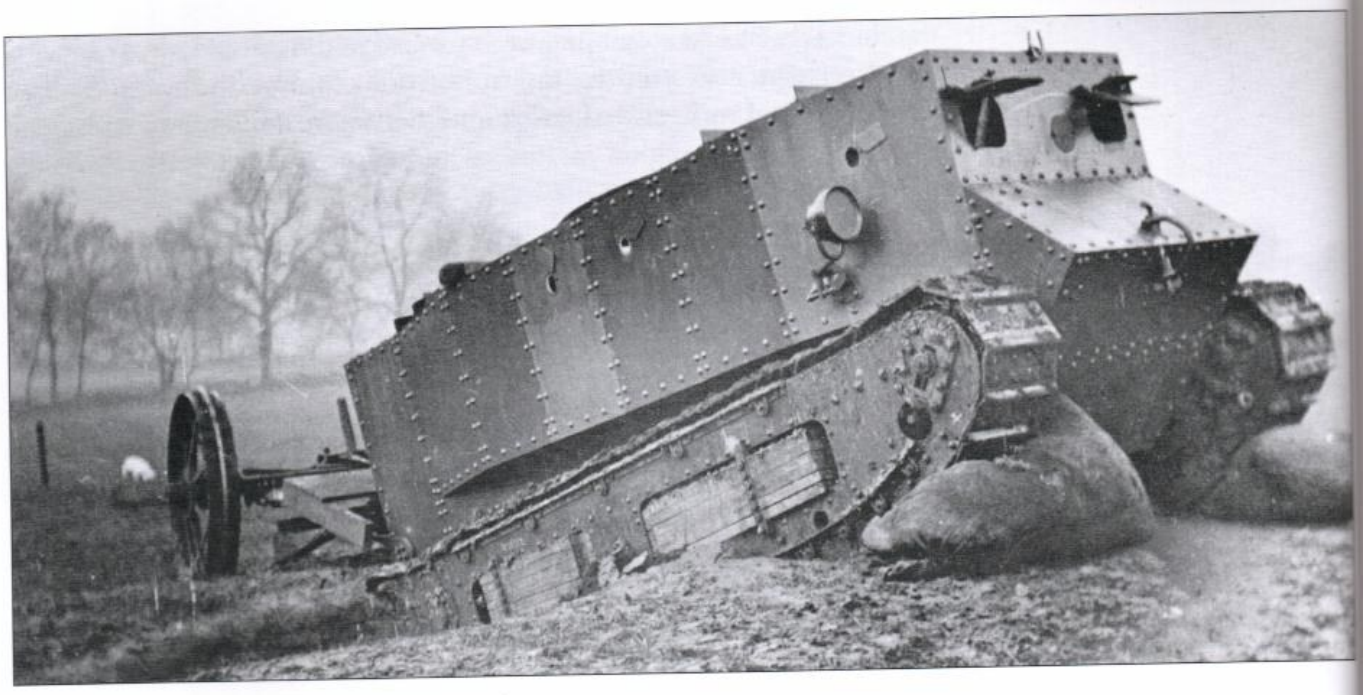
Larger and bulkier than the prototype, this new design was characterised by the way the tracks appeared to run all the way round its body. It is the measure of Wilson's genius that he appreciated, even before the War Office specified it, that a machine intended to drive over rough ground and cross trenches must have the maximum potential mobility. This was all very well but it was also perfectly clear that, unless they could do something about the tracks, the idea would go nowhere. Here was the nub of the problem.

Since very few British firms were producing crawler tracks, and none of them suitable for this purpose, the designers had relied upon American products that were altogether more advanced. Even so these had been designed for agricultural work whereas the tracks required for this new machine had to be stronger and a lot more adaptable. Tritton and Wilson embarked upon a frenzy of invention and succeeded, in a matter of days. They were able to announce the success of Tritton's final track design on 22 September 1915.



The *Lincoln Machine* rebuilt as *Little Willie*. Tritton's new tracks were just 20.5in. (52cm) wide which became standard for all the early tanks. The driver's visor is open, its companion closed and the front machine-gun aperture covered by a round metal plate.

Mundane as it might seem, this was the single most important factor in the evolution of the British tank. Tritton's invention made Wilson's imaginative design possible since it freed the designers from any constraints imposed by the use of ready-made commercial tracks. A set was rapidly produced for the *Lincoln Machine*, which was now renamed *Little Willie*, and it was soon able to demonstrate that they worked. For obvious reasons the two pioneers were by



For trial purposes ballast weights were carried in the track frames to simulate the weight of turret and armament. This photograph, taken in Burton Park, shows *Little Willie* crossing a shallow trench and tackling two large sandbags, representing the parapet.

then heavily engaged on Wilson's improved design and *Little Willie* was already history. The turret was removed, the aperture plated over and it was only used to test the new tracks. Even so it warrants a brief description.

Little Willie

Christened, according to some, with a derogatory nickname for the German Crown Prince Wilhelm, this prototype of all tanks looks, at first glance, little more than a box on tracks and its general appearance can be seen from the illustrations. Internally the space was dominated by the mechanical components. Very little thought appears to have been given to the crew but this was clearly not the first consideration. Two long girders ran the full length of the interior and in effect formed the chassis. The engine was located at the rear, driving forwards, presumably to leave a modest amount of space beneath the turret, which was somewhere near the centre. The Daimler engine was a massive straight six that employed the Knight sleeve-valve system. It was of 13-litre capacity but, for all that, the best it could produce was 105hp at 1,000rpm. It was petrol-fuelled, by gravity feed from two tanks located towards the rear of the hull.

Drive from the engine passed forwards through a cone clutch, incorporated within the flywheel, into a two-speed and reverse gearbox and from there into a massive differential casing from which drive passed, via a series of sprockets and chains, to the track drive sprockets at the rear. Ahead of the differential was a narrow shelf with seats that accommodated the driver, sitting on the right, and another crew member on his left who operated steering levers. These levers operated band brakes on the output shafts of the differential, slowing down one track or the other as required. At the rear, on the right, was the huge, box-shaped radiator.

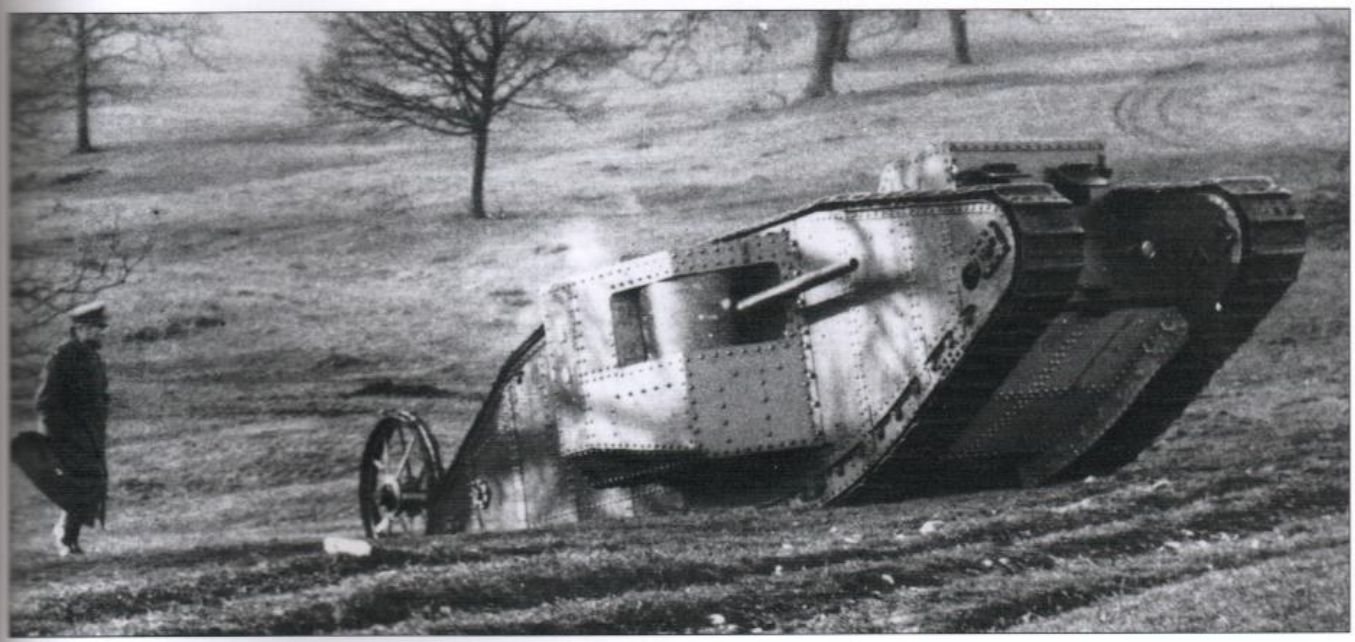
If the turret had been retained it would probably have mounted the Vickers 2-pdr Pom-Pom for which, according to one source, 800 rounds of ammunition would have been supplied. This same source mentions a Vickers-Maxim machine gun, which would have been located at the front of the hull, and Lewis guns for the loopholes along the sides, although it is claimed that the Danish Madsen was also considered.

The track frames had openings in the sides that acted as mud chutes and the frame also featured a series of rollers around which the tracks ran. The sprockets were at the rear and there were adjustable idler wheels at the front on each side. The tracks, as designed by Tritton, consisted of large plates, virtually flat but with a lip along one edge, which were riveted to internal castings. These not only connected one to another by pins, they also slotted into flanges on the faces of the frames that prevented them from dropping away when the vehicle crossed a trench. The most unfortunate result of this was that the vehicle had no springing at all, it simply bumped and clattered along its tracks as they lay on the ground. The track frames were, however, attached to the body of the machine by large spindles at the centre so they were free to swing, to a modest extent, in relation to the hull.

In his original specification for the *No. 1 Lincoln Machine* Tritton had suggested that it should be steered by wheels, which extended from the back like a tail and acted, in effect, like the rudder on a boat. This idea was retained for *Little Willie*, although the entire assembly could now be raised and lowered by means of a hydraulic system attached to the back of the body. This served two purposes: by lifting the tail free of the ground it was easier to swing the vehicle on its tracks alone using the steering brakes while, by adjusting the ground pressure, it would alter the centre of gravity when the machine tackled an obstacle.

Big Willie

The full-size wooden model of Wilson's design for an all-round track machine, which Swinton had seen in Lincoln, was brought up to London in September 1915 and shown to War Office representatives at Wembley Park. To what extent it looked like the tank, as ultimately built, we do not know since no photograph survives. One witness described the weapon sponsons, fitted to the sides, as looking like bow windows, but since the matter of the weapons to be carried had not then been settled this does not signify very much. The final appearance was revealed when the prototype was inspected at Fosters in December but it could not be



Mother **in Hatfield Park. The front of the cab is virtually identical to that of** ***Little Willie*** **but the tracks are now the dominant feature and they limit the driver's view. The weapon sponsons, on the other hand, look like a clumsy afterthought.**

In this near perfect side view the close pattern of rivets shows up well and the sponson appears to be much more a part of the design. The bearing caps just in rear of the sponson indicate the location of the secondary gear shafts.

described as complete until it arrived at Hatfield Park in Hertfordshire in January 1916, for its official trials.

Outwardly it was a dramatic departure from the profile of *Little Willie* although in fact the two machines had a lot in common. Indeed the massive, lozenge-shaped track frames that created the new tank's distinctive silhouette were just enlarged versions of the type fitted to the first machine. Even the body itself was more or less the same shape, but for the raised cab at the front, only now it was sandwiched between the frames, rather than riding on top of them. These frames were extended fore and aft to give an improved trench-crossing capability to meet new War Office requirements and where they protruded, ahead and behind the body, these extensions were referred to as horns.

Various weapons had been considered but there was inevitable conflict between what was ideal and what was available. In the end the Admiralty came up with a stock of spare weapons. Known as the Six Pounder, Single Tube, this was a 1915 modification of a Hotchkiss 57mm design first taken into service by the Royal Navy in 1885 as a quick firing gun, the term referring to a piece with quick action breech that took a complete round. It had a long (2,280mm/89.76in.) barrel, a maximum range of 6860m (7,500 yards) and a muzzle velocity of 554mps (1,818ft).

The problem of fitting the weapons was exacerbated by two factors. The tall narrow shape of the machine meant that a turret on top could raise the centre of gravity dangerously high; the way the tank was laid out inside meant that it would have to be located directly above the engine, leaving no room for a gun crew who might well have been cooked alive in any case. On advice from the Director of Naval Construction, Eustace Tennyson d'Eyncourt, the designers adopted side-mounted sponsons, not unlike the system used on some warships of the period. The sponsons took the form of wedge-shaped structures hanging from either side of the hull. A gun was mounted in each, fitted to a pedestal base that gave it a 100-degree arc of fire. A curved shield, fitted around the gun and moving with it, sealed off the aperture, although there was a vertical slit in the

Tritton, Wilson and Stern are among the group gathered around *Mother*'s starboard sponson. Notice how the door swings outwards but against the hull. The small, oval door at the rear is also open and can just be seen over the tracks.

shield for a simple telescope sight which was also attached to the gun mounting. Traverse and elevation were entirely manual, aided by a folding stock that tucked under the gunner's right arm, and there was a pistol grip and trigger for firing. The loader served the gun from the right, with the gunner on the left so there was a slight difference in the design of the two sponsons to prevent the crewmen being squashed. This in turn affected the movement of the guns so that the starboard side weapon could fire from dead ahead to 110 degrees to the beam while the arc of fire on the port side was from 5 degrees off dead ahead through to 115 degrees.

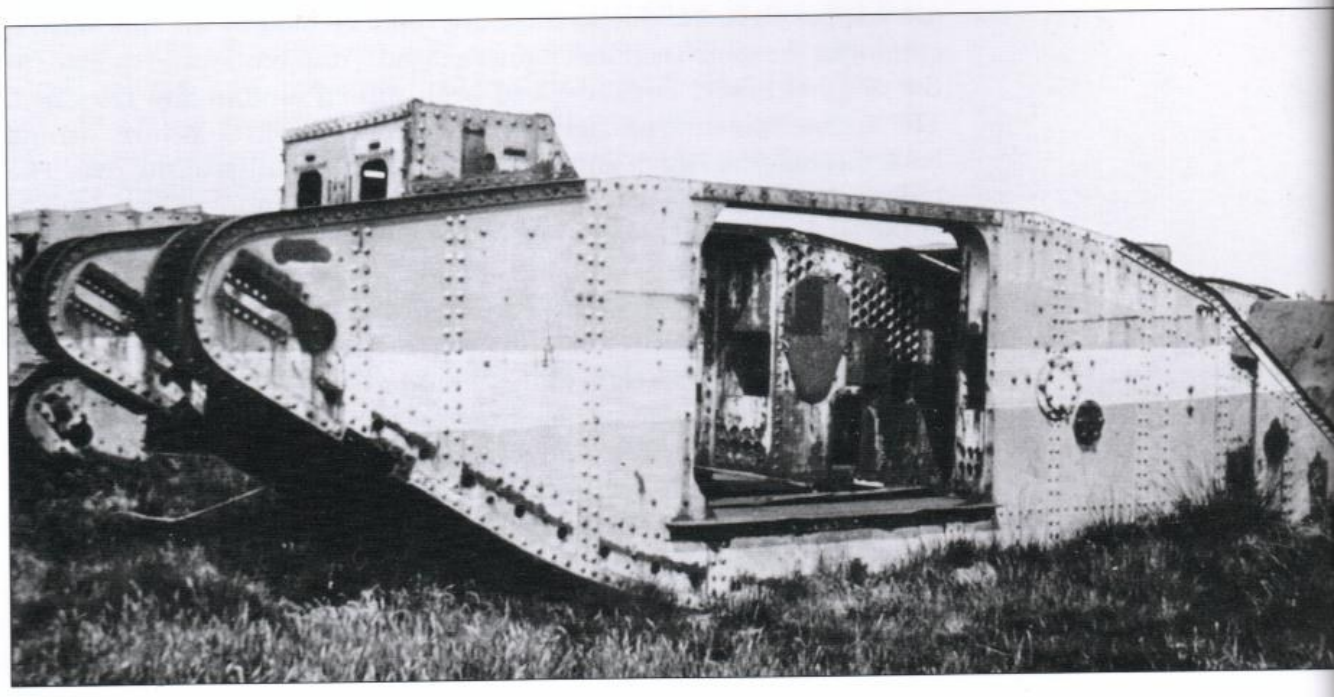
Known officially as His Majesty's Land Ship *Centipede*, this machine, which the Admiralty also called *Big Willie*, has always been better known to history as *Mother*. Compared with *Little Willie* it appeared to be slightly more spacious inside due to the extra room created by the sponsons. It employed the same Daimler engine, gearbox, differential and radiator as the original model but these had been turned around and relocated. The engine was now situated somewhat forward of the centre, driving back through the clutch and gearbox to the differential at the rear. The radiator, with its attendant cooling fan, was located more or less centrally at the back. This, however, is where the similarity ended.

Little Willie weighed something in the region of 16 tons but *Mother* with its larger frames, sponsons and guns tipped the scales at 28 tons. Tritton and Wilson were convinced that a greater range of gears would be needed to cope with the extra weight so they introduced auxiliary gearboxes in the track frames just behind the sponson openings on each side. Thus drive from the differential now passed through these secondary, two-speed boxes and from them to the sprockets at the rear via heavy-duty roller chains. Working under pressure, the designers simply adapted typical traction engine gearboxes for this task so as a result there were exposed gears and shafts, worked by direct-acting levers, within the hull frames of the tank. In addition to providing extra speeds (four forward and two reverse in theory) these gears had a second and, in many respects, a more practical

use in connection with the steering, which will be described shortly. *Mother* also sported a steering tail and track brakes as provided for *Little Willie*; the tail wheels had a raised central rib around the circumference which was supposed to cut into the ground surface in order to grip and in theory would guide the tank in a 60-ft radius curve. Steering this way was hard work and only partially successful since it depended very much on the condition of the ground.

Both *Little Willie* and *Mother* were of riveted construction except on certain areas, such as the roof, which was bolted. This enabled panels to be removed if it proved necessary to lift out the engine. The body of the tank, main hull and track frames, consisted of a framework of girders to which the plates were attached. It should be pointed out that for both prototypes no armour was fitted, in the sense of bullet-proof plate. Rather panels of ordinary steel were used, normally referred to as boilerplate. *Little Willie* was constructed with the rivets spaced at girder-makers' pitch (roughly 140mm apart) but for some reason, when *Mother* was built the rivets were set at boiler-makers' pitch. This is much closer, to achieve a water-tight joint in boilers, and could have advantages in a tank. For one thing it would make the structure that much stronger and it would also ensure a better fit of plates, thus reducing the risk of splash from impacting bullets squeezing through. Disadvantages might be extra weight and longer production time. Whatever the reason this feature is peculiar to *Mother*; none of the subsequent production tanks were treated in this way.

On 29 January 1916 the new machine gave a demonstration of its capabilities in the grounds of Hatfield House. It tackled trenches, shell holes, swampy ground and wire entanglements without a hitch and appears to have impressed everyone who saw it. Four days later it repeated this before a distinguished audience that included Field Marshal Kitchener who, to the dismay of those present and the confusion of historians ever since, made an unfortunate remark about a 'pretty mechanical toy' before leaving; a strange contrast with his strong advocacy of air power. Ten days



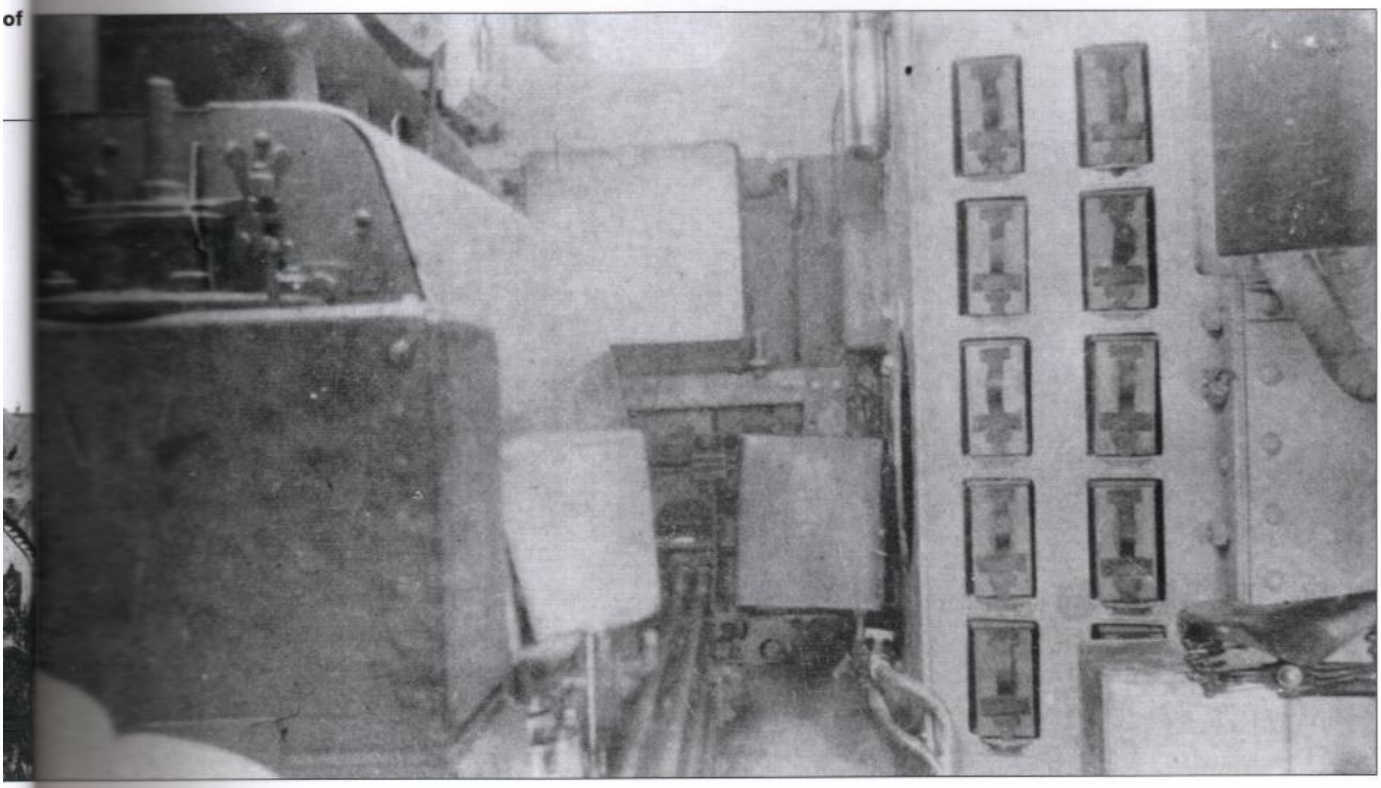
Stripped to a bare hull, with no sponsons and the top plates missing, *Mother* was retained with other preserved tanks at Bovington after the Great War but was subsequently broken up for scrap. The stripe along the side was an identifying mark from the Oldbury Trials of March 1917.

later the Army Council placed an order for 100 machines, which were now being referred to by the code name of 'tanks'. The order was split between Fosters of Lincoln and the Metropolitan Carriage, Wagon and Finance Company of Birmingham, although one source claims that seven were assembled by Robey and Company, also based in Lincoln. By this time the project had been transferred to the Ministry of Munitions, although the Admiralty continued to supply personnel for testing and experimental work. Clearly from now on the machines would become the responsibility of the War Office.

BUILDING THE TANKS

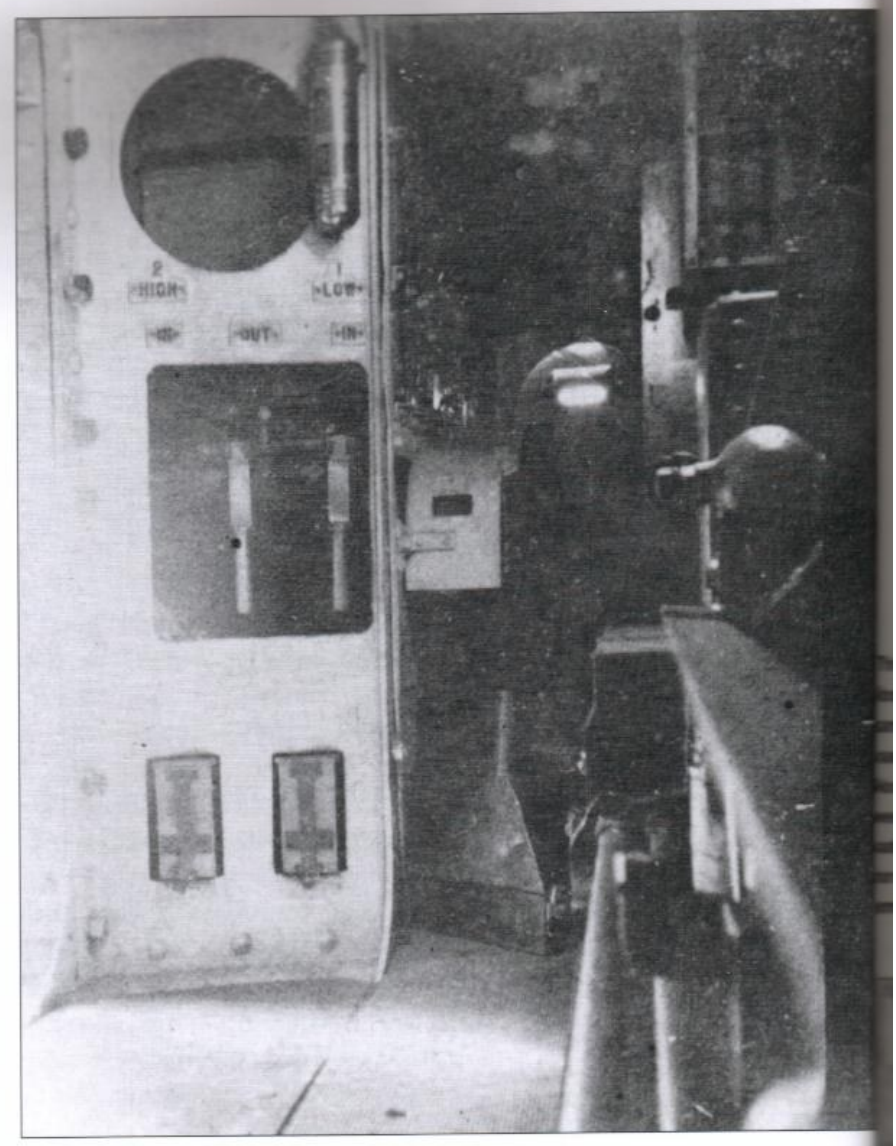
Male tanks: 701–775
Female tanks: 501–575

A good deal of research on thin armour plate had already been undertaken by the Royal Naval Air Service for its armoured cars, in conjunction with the William Beardmore Company of Glasgow. With the war at a crucial stage good quality steel was in short supply and it proved equally difficult to find companies with spare production capacity. In the end this was only achieved by taking the steel from three firms which could each produce a certain amount. Two thicknesses were required: 10mm to cover vital areas and 6mm elsewhere. It was cut and drilled by the manufacturer in its soft state and then put through a hardening process that involved first heating the plate and then cooling it rapidly while pressing it flat. The variety of suppliers added to the logistic problem since the plate had to be transported, from Glasgow or Sheffield, to Lincoln and Birmingham while track links also came from Glasgow and the mechanical components from Coventry.



View looking forward on the right side of a Female tank. Notice the gunner's saddle on the right and the ammunition boxes in their racks. Near the top is a Pyrene extinguisher, left of that the clutch hand lever and the back of the driver's seat.

The basic shape of the tank was first assembled from angle-iron frames to which the armoured panels were then riveted or bolted as required. The engine and other internal fittings were lowered in from above and a set of 26 twin rollers inserted along the lower part of each frame. Ten of these rollers were fitted with sprung flanges intended to keep the tracks in line; skid rails carried the track over the top of the frames. A toothed idler wheel was installed at the front of the frame on each side and a similar toothed wheel at the back that meshed with the track links acted as the drive sprocket. Stretching of the track was countered by making the front sprockets adjustable to take up the slack. If this were not done regularly the tracks might come off but even then they were usually worn out after about 25 or 30 miles (and drive sprockets only lasted for about 20 miles). Viewed in profile it will be noted that the track frames were not flat, where they ran along the ground, but gently curved. This meant that on a hard surface no more than eight track links per side (from a total of 90 that comprised a complete loop) were in touch with the ground so that the tank might turn easily. On soft ground, however, more links pressed into the surface, thus gradually reducing the overall ground pressure, but this made it increasingly difficult to turn, due to the lateral resistance of the soil.



Looking backwards on the right side, the other saddle can just be seen in the glare from the open door. At the centre the two starboard auxiliary gear levers hang down, above them another Pyrene extinguisher alongside the gear lubrication tank.

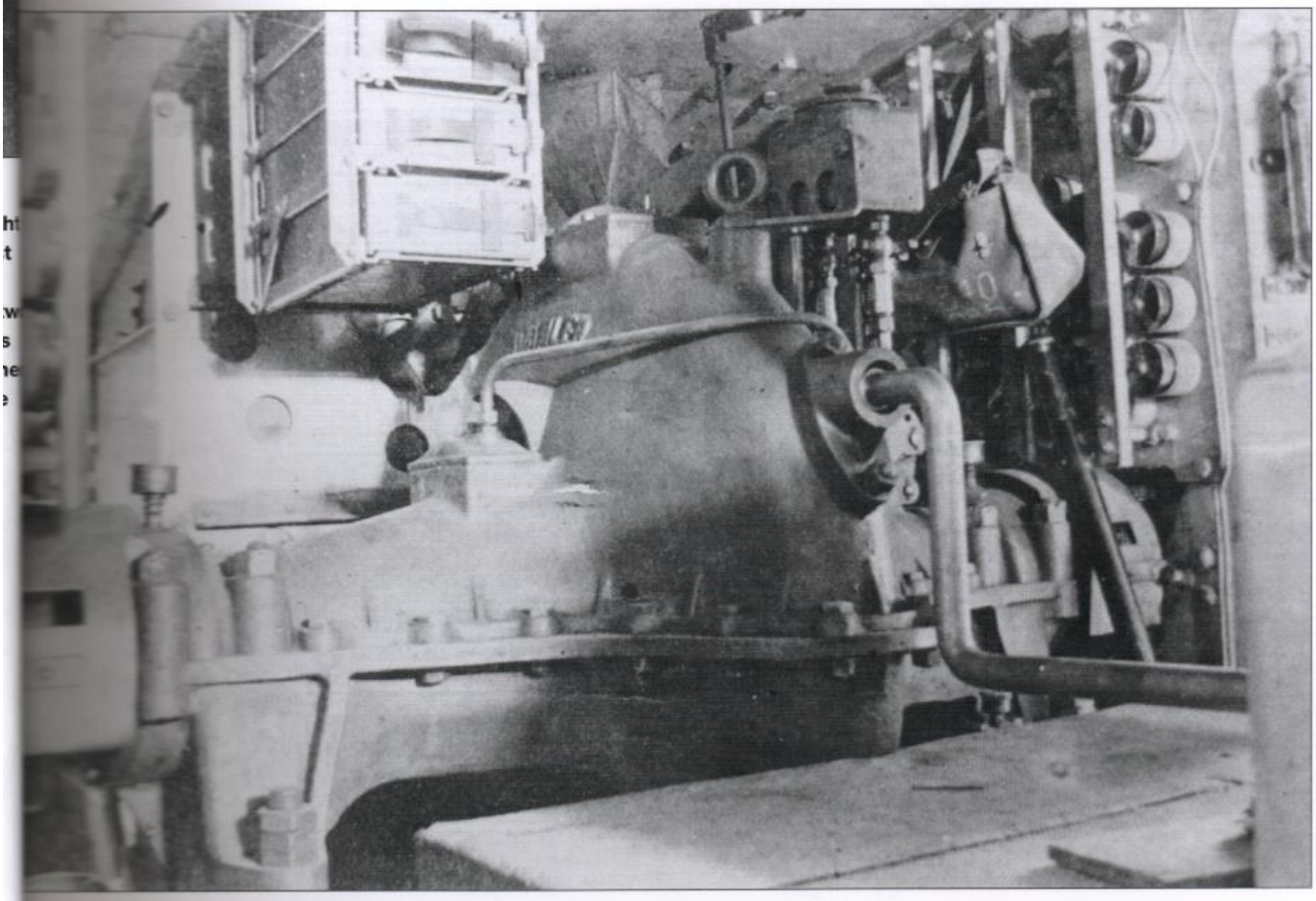
The original War Office order for 100 tanks was divided so that Metropolitan were to build 75 machines with the balance coming from Lincoln, reflecting the relative capacity of the firms involved. Metropolitan set up their production line at one of their constituent companies, the Oldbury Railway Carriage & Wagon Company, and in April 1916 they received a further order for 50 tanks. The whole batch of 150 tanks would subsequently be classified Mark I when new models appeared. The increase in the order was in line with a War Office decision to raise six tank companies, each of which would have 25 tanks, but it quickly created another problem. There would not now be enough guns to equip them all so it was agreed that 50 per cent would be armed with heavy machine guns instead.

The new sponson, intended to carry a pair of Vickers water-cooled machine guns, looked as if it had been designed in a hurry. Cumbersome

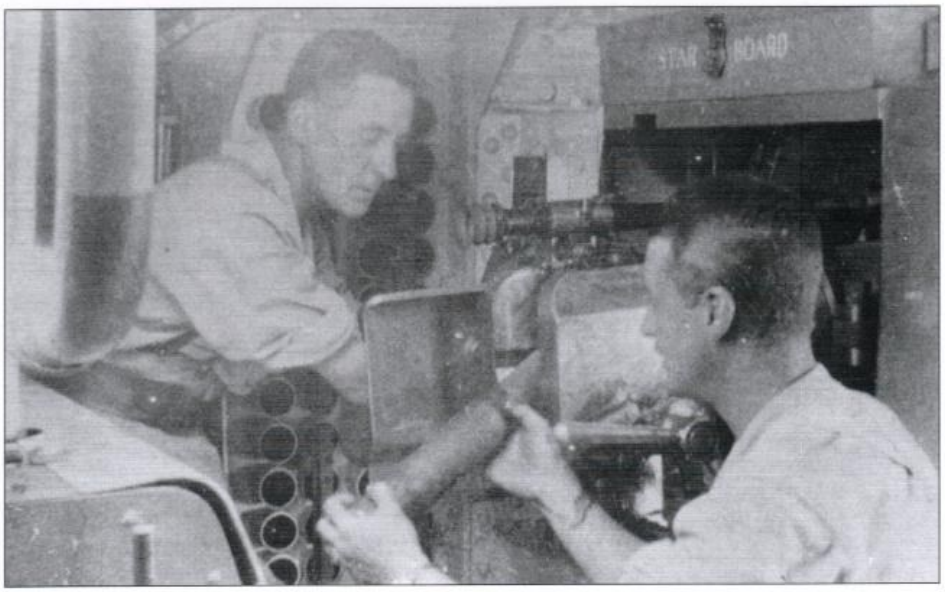
in shape and size, it had to fit the same aperture as the 6-pdr sponson and give both guns an arc of fire sufficient to cover the entire side of the tank. As a result the access door could not be full height which meant that it was very difficult to enter with any dignity and virtually impossible to get out of in a hurry, rendering the tank a death trap in an emergency. Once inside, the machine gunners sat on bicycle-type saddles, attached to the pillars that supported the guns, while each weapon was encased, around its barrel, in a protective armoured jacket so that an extended foresight had to be fitted to the gun where it protruded above the armour.

In order to distinguish between the two types, those tanks fitted with 6-pdr guns were designated Male, while machine-gun tanks were known as Female. This, of course, means that *Mother* was in fact a Male. These first production tanks differed from *Mother* in many details, only a few of which need to be noted here. Additional springs were added to the tail assembly, presumably to increase ground pressure and give extra support during trench crossing. Perforations in the hull plates above the radiator were eliminated and baffles, in the shape of an inverted V, were located above the three exhaust outlets. The round lookout hatch on top of the hull was moved back to the next panel and, as already mentioned, rivet spacing reverted to girder-makers' pitch.

That this first design was crude goes without saying. It was inevitable under the circumstances but it is a fact that has often been ignored when the failures of these first tanks are discussed. Even so there is one feature that might have been questioned from the outset and that is the location



The huge Daimler differential dominates this view of a Male tank. Ahead of it the starting handle, behind it the radiator. Notice how the 6-pdr rounds were held in place by wooden battens, and see also the rack for boxes of machine-gun ammunition.



Gunner and loader at the starboard sponson on a Male tank. They have no seats but cannot stand upright. The loade offers up a round to the breech, alongside is a shield to protect the gunner and above that the sighting telescope.

of the fuel tanks. For the sake of simplicity it was agreed that gravity feed should be employed and this naturally required the fuel to be located as high up in the vehicle as possible. This was achieved by fitting two 25-gallon tanks in the front of the hull frames, on either side of the cab. They must have been tiresome things to fill, since there was no external access, and if the tank went nose-down into a trench there was a fair chance that the petrol supply would be cut off. Worse still was the risk of fire; in the event of a fuel tank being hit in action the interior would become an inferno in a matter of seconds. There would be no chance at all for the men at the front and precious little for any of the crew of a Female machine, with its poor escape facilities.

Although it was understood that the armour was only adequate to resist small-arms fire, and shell fragments to some extent, there was a fear that bundles of grenades, thrown onto the roof, might do severe damage. Trials revealed in June 1916 that a burster plate, spaced 30cm (12in.) from the top of the hull, would prevent damage. According to Metropolitan, 25 sets of 4mm thick perforated plate were manufactured, but never fitted, although some tanks were completed with extra studs to attach them. Later a gabled roof of wood and wire netting was designed, reportedly by Walter Wilson, and fitted to some C Company tanks when they went to France. That there was good reason for this was discovered when, later in the war, an old Mark I was tested against grenades. A bundle of five, detonated on the roof, would do substantial damage and might have injured the crew, and similar trials against the tracks revealed that, if they did not break, they would be damaged sufficiently to immobilise the tank.

CREW DUTIES

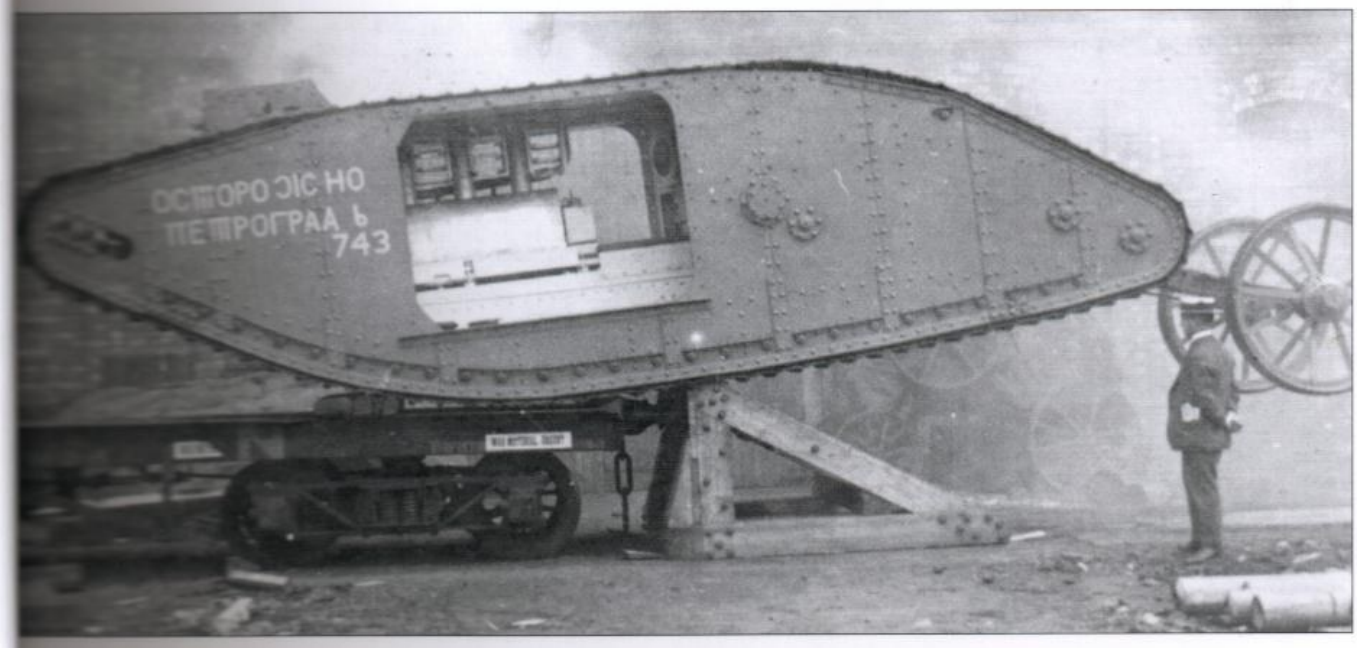
The basic mechanical functions have already been described but the task of driving an early tank was very much a team effort. Up to four men were needed to start the engine, turning a crank handle located above the gearbox. Once it was firing the driver engaged first or second gear as ground conditions dictated and signalled the gearsmen to do likewise. Conditions inside the tank were appalling. Noise from the engine, within

the confined space, was so loud that it was impossible to hear someone shouting, never mind normal speech, and before long the internal temperature could rise to 50 degrees Celsius (120 degrees F) or more. Worse still the engine was soon gushing clouds of carbon monoxide from its exhaust, which could render the crew temporarily ill and mentally confused. Add to that fumes from the internal fuel tanks, guns, and sweating humanity, and it was all particularly unpleasant.

According to Colonel J.F.C. Fuller the steering tail was a nest of troubles. Besides being very hard work for the driver, the cable which ran from his steering wheel to the tail often stretched or came off the pulleys, and if that was not bad enough the hydraulic apparatus at the back was always giving trouble.

Aside from the tail wheels the crew had three ways of steering the tank. To 'steer slightly' as the *Tank Driver's Handbook* put it, the commander, sitting alongside the driver, applied the appropriate track brake. This slowed down one track while the other continued to run by differential effect. However, the strain was tremendous, both on the operator, struggling to fight the power of the engine, and the brake linings themselves which wore out rapidly, requiring continual adjustment. To swing the tank, that is to turn it through a considerable arc, the driver locked the differential and signalled the gearsmen to engage or disengage the secondary gears depending on the direction of the turn. With a brake applied to the disengaged track the tank would turn on the spot, pushed around by the driven track. This could only be done by first halting the tank, and once the manoeuvre was complete it had to stop again while the gears were reset. The third method, to induce the tank to 'turn quickly', was also described. This involved leaving the differential unlocked, engaging high ratio on one side and low on the other and, if need be, applying the track brake on the 'high' side. Thus the tank turned towards the high ratio side. Other sources claim that this practice damaged the secondary gear shafts so it was generally discouraged. It would in any case require a great deal of manual dexterity and co-ordination to be effective.

Tank 743 climbs over a portable ramp, onto a railway wagon in Foster's yard. The sponsons have been removed, revealing the engine and exhaust stacks. Clouds of fumes swirl around the vehicle; whenever the engine was tilted, displaced engine oil was burned in this way.

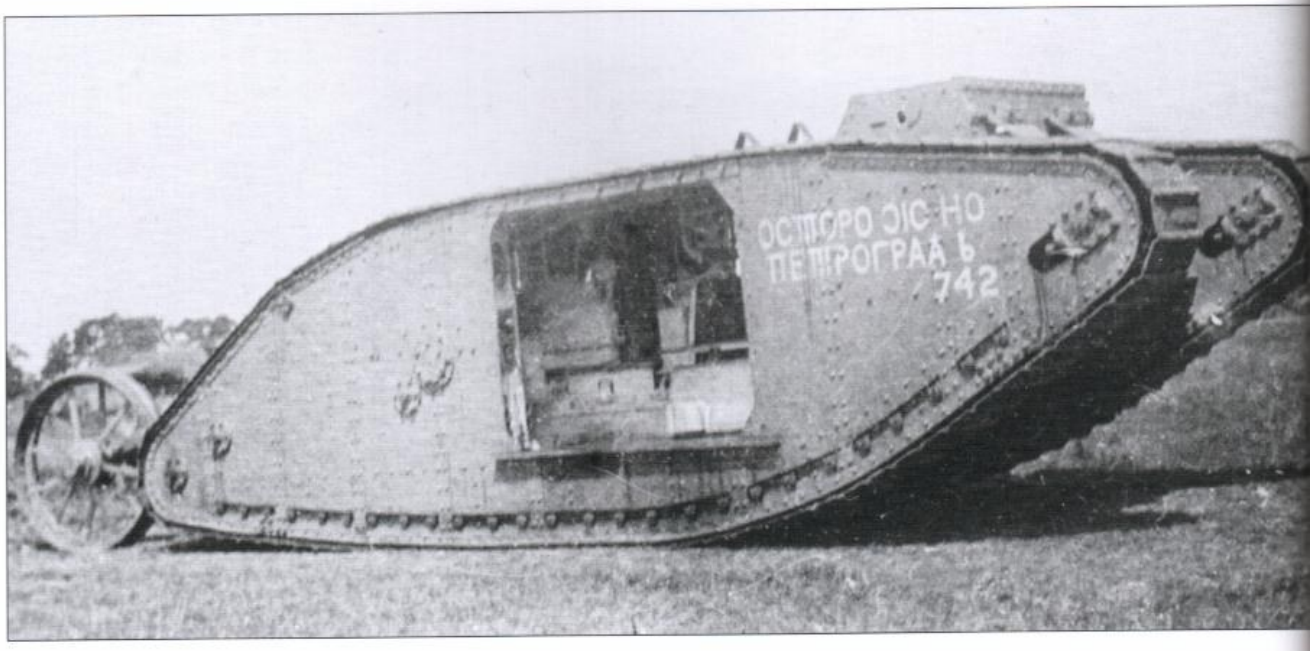


The role of the secondary gearsmen was not limited to steering. Every 30 minutes or so they had to squirt thick grease over the gears and, when they were not doing that, keep an eye on the engine. During a fight they also passed ammunition forward.

In addition to the controls already mentioned the driver had a footbrake, which acted upon the main drive shaft, just behind the differential. If anything this worked too well and, if not used with care, could wreck the gears. In theory it was also possible to stop the tank by hauling back on both steering brakes but in practice, at least on level ground, the tank would stop anyway, as soon as the clutch pedal was depressed.

Drivers were enjoined to approach all obstacles square-on and keep moving. When tackling a steep slope the drill was to lock the differential to prevent either track from slipping during a climb and engage low gears when descending. The instructions were to drive as fast as possible over soft ground to prevent the tank from bellying, but since the top speed was only about 5km/h (3mph) this was a relative term. On firmer ground tree stumps and other hard obstacles were a threat. The ideal was to drive over them with the tracks and not let them get beneath the belly of the tank because, if they stuck, the lower hull plates would be forced up until they fouled the flywheel and brought the tank to a halt.

Turning now to the gunners; on a Male tank their roles were obvious but not easy. For one thing both gunner and loader were unable to stand upright or sit down but had to bend over the gun. The gunner used his body weight to elevate or traverse the weapon while squinting through a crude telescopic sight. Firing the 6-pdr accurately on the move was completely impossible since vibrations from the unsprung tracks, transmitted through the body of the tank, caused the telescope to vibrate so that the gunner could not see anything. This was not a problem for the machine gunners in Female tanks who were firing for effect most of the time anyway. The Male tanks carried three Hotchkiss air-cooled machine guns; one in the front, operated by the commander or driver as needed, and one in each sponson, behind the main gun; these could be fired by the



During initial training at Thetford tanks invariably ran without their sponsons, which some felt was foolish. Notice the vision slit and open pistol port on the side of the cab. It also clear that 742 has been losing a lot of engine oil.

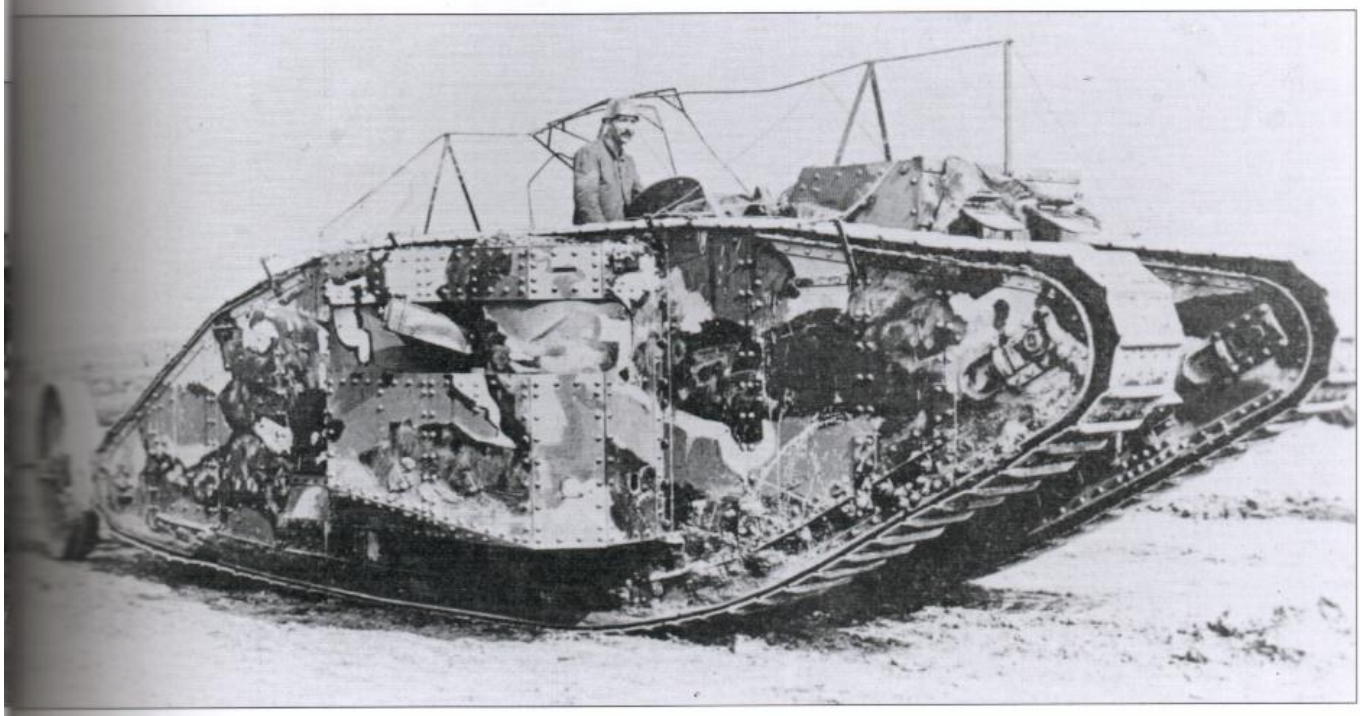
loader or gearsman. The loader, of course, also had to dispose of empty 6-pdr shell cases, which was done by dropping them through a narrow opening at the base of the sponson door.

A Male tank carried 334 rounds of 6-pdr ammunition in various locations around the tank. The ammunition available at the outset was a gunpowder-filled, common pointed projectile with a base percussion fuse. The Female tanks carried 24,320 rounds of Vickers .303in. ammunition packed in 76 boxes containing 320 rounds each.

Shortly before the tanks went to France the War Office asked the Admiralty Compass Department to advise on the matter of compasses in tanks. They decided upon a boat compass, the sort of thing that is carried in ship's boats. The compass had to be carefully adjusted to counter the deviating effect of a dense mass of metal. Even so, according to some sources, the compass deviated every time the driver moved the gear lever and one wonders how it stood up to the continual vibration.

Finding room for all the other items needed when a tank went into action provided another challenge. Captain Basil Henriques, who commanded the Female tank C22 during the first tank action, said that, in addition to iron rations his crew carried 16 loaves of bread and 30 tins of food, along with cheese, tea, sugar and milk. That may have satisfied the crew, but what about the tank? To keep the machinery going the crew needed a spare drum of engine oil, another of gear oil, two small drums of grease and three cans of water. On top of that they had to find room for a first-aid kit, two boxes of revolver ammunition, a spare Vickers machine gun and four spare barrels for the Vickers and one for a Hotchkiss, two wire cutters and three signalling flags which, according to Henriques, they could never find when they needed them.

Many tanks had a wooden box made to fit on the tail frame, in which they carried extra cans of petrol. In his book *Sagittarius Rising* Cecil Lewis, who was flying observation patrols with No. 3 Squadron, Royal Flying Corps, on the day tanks attacked for the first time, mentions



This well-known photograph is now believed to have been taken at Thetford. It shows a Female tank finished in Solomon's exotic camouflage. The net on top may be an early experimental wireless aerial and the NCO is wearing a leather tank helmet.

seeing tanks refuelling in the village street of Flers 'the red petrol tins visible on their brown backs'. Another commander claims that each tank carried a coil of wire cable on the back, equipped with hooks, which could be used to tow other tanks out of trouble.

Each crew member was issued with two gas helmets, one pair of goggles and a leather helmet to shield his head from contact with the hull, in addition to his water bottle, field service cap and haversack, all of which had to be put somewhere. The tank crew personal weapon was the revolver, which could be fired through a selection of protected loopholes located all around the tank. This was necessary to discourage mass attacks by enemy infantry who, if they could get aboard the machine, would strive in every way possible to get at the crew. There was even a pistol loophole in the lower sloping plate at the front so that the driver or commander could shoot downwards as the tank nosed over a trench. Some tanks carried a ninth man who was wedged at the back, alongside the radiator, to shoot through a loophole in the tiny rear door at anyone foolhardy enough to think they might climb up over the tail.

With all openings closed, the crew relied on a few tiny festoon lamps to illuminate the interior. As built, the tanks also had headlights and a small, red tail-light but these lasted hardly any time in action. Looking out from within the tank was equally difficult. The driver and commander had slim periscopes, projecting through the roof of the cab and large, hinged flaps in front of them which opened in two stages, first to reveal a narrow slot and then a large opening for driving when out of action. There were also permanent slits in the front and sides of the cab and in various locations on the sponsons. These were covered on the inside by castings which held glass prisms, but these did not allow very good visibility and invariably shattered under fire. In addition to the signal flags

Everyone stops to watch as C1 *Clan Leslie* makes its way alon Chimpanzee Valley en route to the front. The camouflage is particularly striking and includes the gun barrels. The driver appears to be using the tail wheels to bring the tank's nose round a few degrees.

Another classic photograph; C15 moving up for the attack on Thiepval on 26 September 1916. Mud is thickly plastered at the front and seems to have obliterated much of the camouflage. The tank is running with its tail clear of the ground, the gun on full elevation and doors shut.

mentioned by Henriques some tanks carried a pair of carrier pigeons in a basket, a signalling lamp and a telephone handset with 100 yards (say 90m) of telephone cable. The optimistic theory behind this last item was that the tank would leave a second handset at its starting point and reel out the cable as it went. Since the tanks were expected to travel more than 100 yards this notion was soon abandoned.

TRAINING FOR WAR

The first tanks were ready to leave the factories in Birmingham and Lincoln by the middle of June 1916. A special training ground, isolated from the public gaze, had been established on a large shooting estate near Thetford in Norfolk and it was here that men newly recruited to the Heavy Section, Machine Gun Corps, first encountered them. To begin with they only had *Mother*, now shorn of her guns, and progress was slow, but as more tanks arrived it speeded up.

The tanks had to travel by rail and, since they were too wide to clear the loading gauge, they had their sponsons removed for transportation. This was a difficult and time-consuming process that involved fitting trestles to the roof of each tank, from which chain hoists were slung to take the weight as the sponsons were unbolted. Special four-wheeled trailers were built to carry the sponsons but there is evidence to suggest that the tanks used for driver training at Thetford ran without their sponsons for most of the time. Certainly one newly joined officer criticised this, arguing that without sponsons fitted the crews did not get a realistic experience of conditions inside a tank. For one thing a pair of sponsons weighed in the region of 3.5 tons and their absence made a considerable difference to how the tank behaved. Also, of course, with the sponsons removed

ventilation was vastly improved and, insofar as it affected manoeuvring, the driver had no need to account for the additional width of a complete tank.

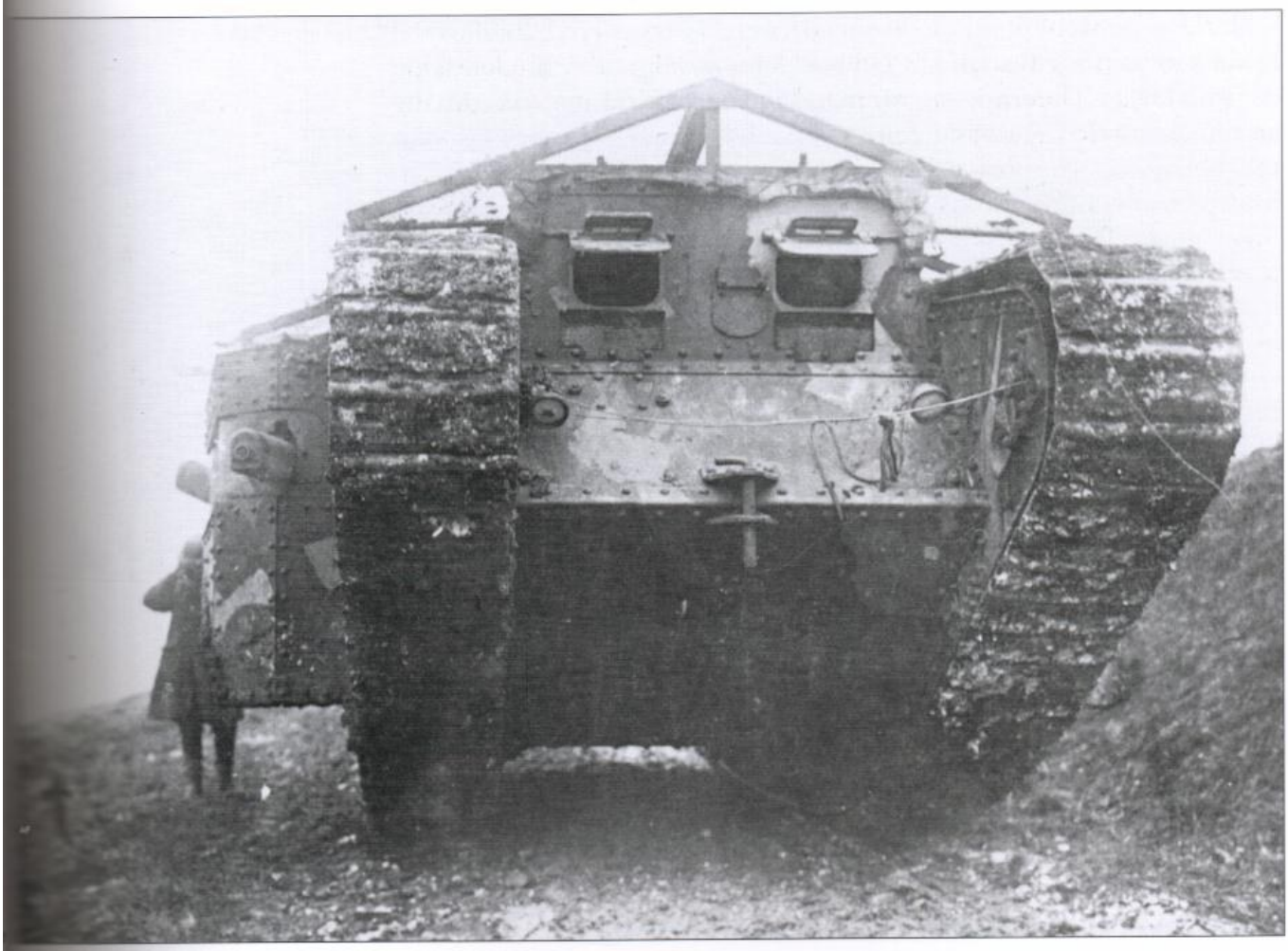
Training at Thetford was restricted to mechanical matters, driving and maintenance. For basic gunnery training on the 6-pdr troops went to the Royal Navy's gunnery school, HMS *Excellent* on Whale Island in Portsmouth Harbour. The greatest difficulty was in finding a means to train the men in the far more difficult task of firing the guns from the tanks themselves.

Various factors conspired to delay production, but once it got into its stride tanks were being manufactured at the rate of about 25 per week. Shipments to France began on 13 August 1916 when 13 tanks of C Company left Thetford by rail for Avonmouth docks and thence by ship to Le Havre. From there, again by rail, they were moved to a site near Abbeville for a period of training and familiarisation with the troops who would later accompany them into action. The next move took them to a railhead known as The Loop, near Bray-sur-Somme where they would be prepared for action. Under pressure from General Headquarters in France the tanks were required for a battle due to begin in mid-September.

OFF TO WAR

The organisation favoured by the War Office was for each company to consist of four sections, each of six tanks (ideally three Male and three Female) plus one tank per company as a spare. In all there were some 60 tanks in France at this time. Twenty-five had been issued to each of the two companies (C and D) of the Heavy Section, Machine Gun Corps; a further ten were retained in reserve, although some immediately replaced a few that had broken down during training and could not be repaired for want of spare parts.

D7 ditched. Notice the two periscopes sticking out of the cab roof, the top hatch, the front Hotchkiss machine gun still in place and the camouflage box on the tail. D Company had to manage without anti-grenade roofs on their tanks but see two crew members wearing their leather helmets.



Close-up frontal view of a female Mark I, probably of A Company during the November 1916 actions. This company also employed the grenade-proof roof, but this one seems to have an extension over the top of the sponson, which would make sense.

The battle plan reflected an understandable lack of experience or even comprehension of what these new weapons were supposed to do. Prevailing logic suggested that they should be employed against identified strongpoints in the German line to which end special lanes were left open through the British barrage, along which they would advance. The scheme was nearly wrecked on over-confidence. Demonstrations laid on before the battle seemed to suggest that there was little the tanks could not do. In practice, as they struggled up to the start line in the dark, some lost their way and most became entangled with other traffic so that, by the time they arrived, the crews were exhausted and fuel reserves low. Since many of these men had no previous experience of war, and most notably of the horrific conditions of the Western Front, everything must have been bewildering.

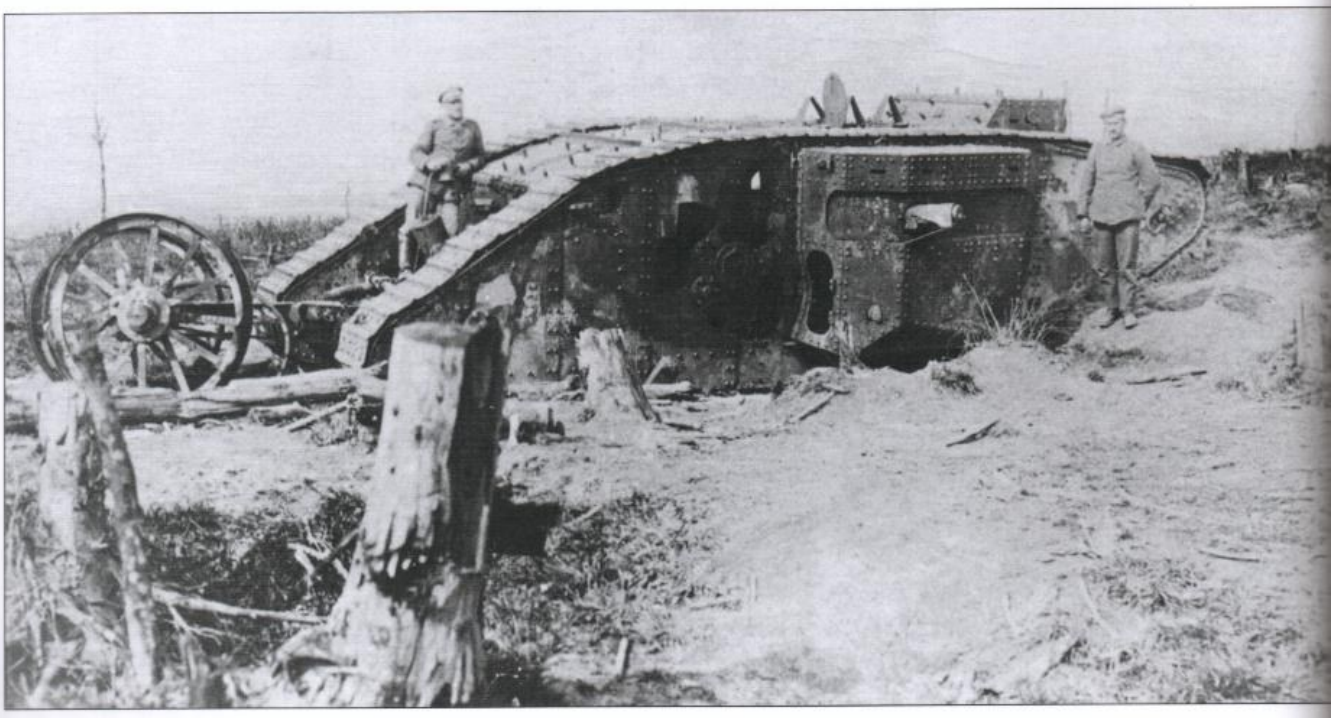
The first tank battle, known as Flers-Courcelette after two villages that were objectives for the attack, was part of the 1916 Somme campaign and it was scheduled to start at 6.20am on 15 September 1916. In fact it began about one hour earlier when Male tank Number 765, crew D1, under Captain H.W. Mortimore started to move. In theory this should have been one of three tanks but the other two were delayed. This situation was repeated all along the front since just 32 tanks, out of 49 originally available, were ready to start on the day. Of these, five were soon ditched in trenches or shell holes, nine broke down, nine more were too slow to keep up, but did some useful work mopping up, and the final nine led the way, got well into the enemy lines and caused considerable damage.

In the thick of it more problems were encountered. Both Basil Henriques and Lieutenant Vic Huffam, who was in action the following day with D9, reported that enemy machine-gun bullets came through the armour and killed or wounded members of the crew – it may be relevant that both tanks were Females. They also agreed that bullets striking glass prisms in the vision blocks shattered them, sending splinters into the driver's eyes. One tank (C5 *Crème-de-Menthe*) lost one of its tail wheels but it is a measure of contemporary inexperience that, when another tank had its entire tail assembly blown off, the commander believed his tank to be incapacitated.

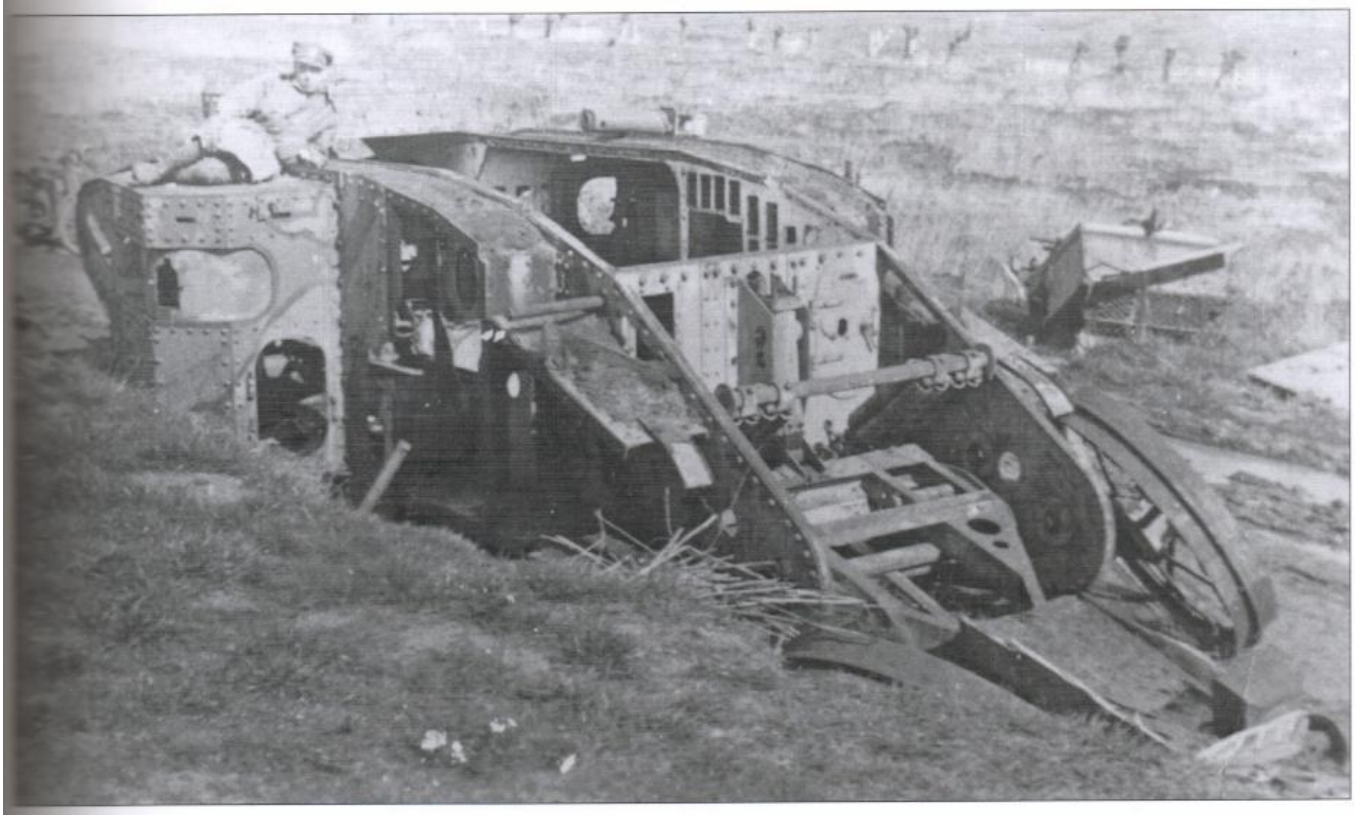
The lack of a silencer for the exhaust system proved to be another problem. Great clouds of fumes belched out as the tank tipped in and out of shell holes and, after dark, sparks could often be seen spiralling up around the baffles, but worst of all was the noise. Crews improvised, making rudimentary silencers from old oil drums or packing mud around the baffles, or even wet sacks.

Three tanks were in action on the following day (16 September). They managed to stem a German counterattack near Flers but they were all hit and put out of action. Indeed Huffam, in D9, recalled seeing Court's tank literally smothered in shellfire, and it appears to have exploded with the loss of the entire crew. On the whole, however, casualties among the tank crews were light and many of the tanks abandoned on the 15th were subsequently recovered. Those that were not appear to have remained on the battlefield until the very end of the war when some were photographed lying derelict or being broken up for scrap by German prisoners-of-war.

Thus this first attempt at tank warfare can only be regarded as a limited success at best, yet it had a remarkable effect and in a most improbable quarter. Four days after that first battle the British Commander-in-Chief in France, Sir Douglas Haig, sent a representative to London with an order for 1,000 more tanks.



German troops with the abandoned hulk of D13 *Delilah*. This tank appears to have redundant studs for the burster plates on the upper panels. The tiny access door in the Female sponson has been blown off but one can appreciate how small the opening is.

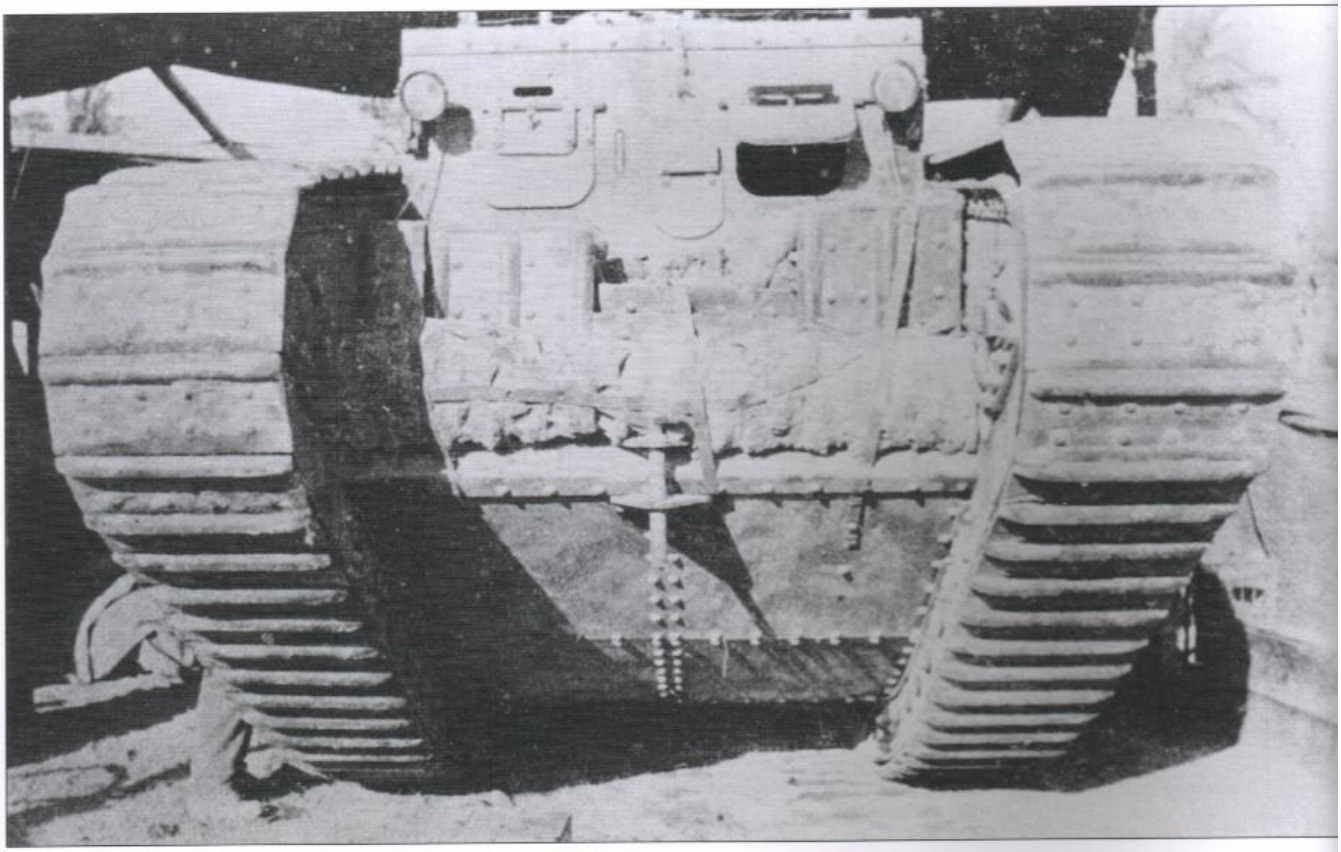


The wreck of D11, photographed much later in the war. Points to note are the vision slits around the top of the sponson, the tail frame with its wooden box, internal stowage for machine-gun ammunition and the spindle for the single top roller. The track skid rails that run along the tops of the frames have been obscured by mud.

A dozen tanks were available for action on 25 September, eight of which were not actually used because the infantry proved capable of undertaking the task without them. Of the other four, two did some minor work and the last pair did not get called into action until it was too late. However, the infantry they were scheduled to help came up against a grim German position known as the Gird Trench near Gueudecourt. One of these tanks was damaged by artillery fire so, on the following day a single tank, commanded by 2nd Lieutenant Storey, took on the Gird Trench by itself. The result was so impressive that some 300 German prisoners were captured and Storey was awarded the Distinguished Service Order for 'gallantry and initiative'. Haig himself noted on the citation 'I consider this to be the best tank performance up to date'.

At the end of September command of the tanks in France was given to Lieutenant-Colonel Hugh Elles, Royal Engineers, who retained this post right through to the end of the war. Tanks were used in small numbers throughout October but weather conditions deteriorated and there were few successes. Even so the tanks were here to stay, a fact signified by a War Office announcement on 20 October that the force was to be enlarged and companies expanded to form battalions.

In reviewing these early actions some general comments can be made. In the first place it was immediately clear that the steering tail wheels were a complete waste of time. Some were lost in action and the affected tanks performed just as well without them, although trench-crossing ability was reduced to some extent. The sponsons were also regarded as too large. The Male type tended to dig into the ground, bringing the machine to a halt, while the Female pattern was a very poor design and badly made since it tended to let bullets through. The 'grenade-proof' roof was equally troublesome and the elaborate camouflage schemes were soon obliterated by mud running down from the tracks. Mud also found its way inside, and



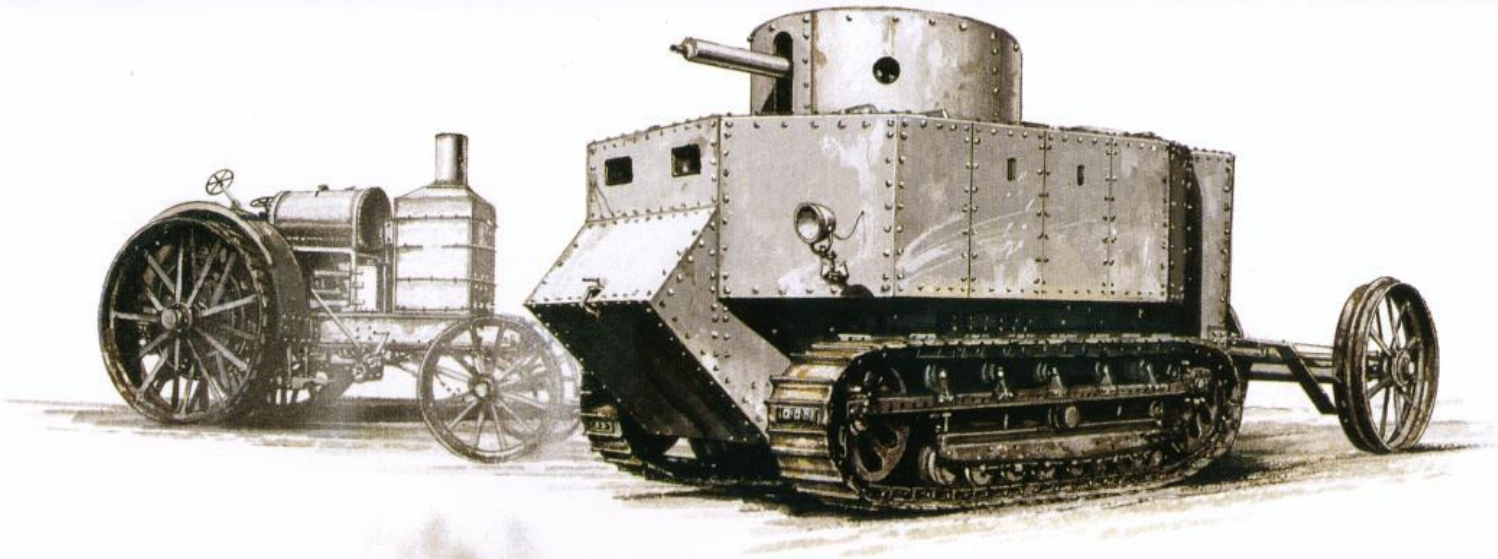
Spare track plates and what looks like part of a palm tree have been used to beef up frontal protection of this Mark I in Palestine so the headlamps have been relocated. The spikes just visible at the top appear to have been used to hold additional stores in place.

clogged up the final drive so much so that, according to B Company, it was impossible to operate in top gear.

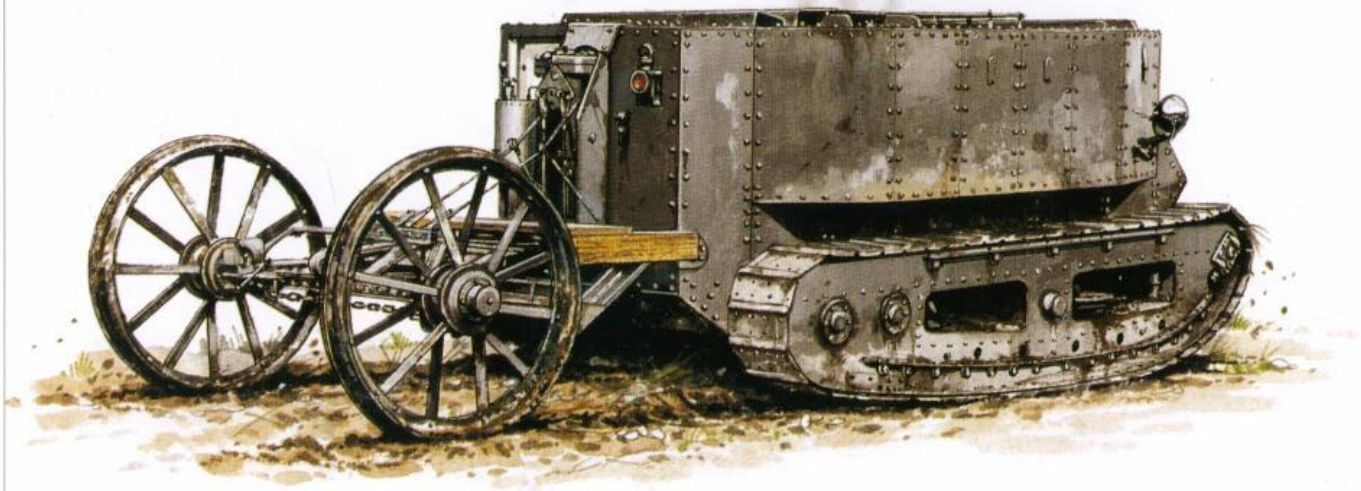
Reliability was clearly a key factor. Much was due to poor workmanship, which Wilson had already complained about, but it also had to do with inexperience on the part of crews who were not yet skilled enough to select the best ground or to anticipate mechanical failures in time to put them right. For the long term there was also criticism of the amount of track adjustment, the width of the tracks themselves and, inevitably, the location of the fuel tanks. These and many other matters of detail were corrected on Female tank Number 555 which became an experimental test rig for the next model. The modifications included a narrower cab to accommodate wider tracks and a single enlarged fuel tank at the rear, in the space formerly occupied by the tail wheel frame.

For the immediate future the main problem was a desperate shortage of tanks. A Company, which had been in France since 14 September, had its baptism of fire on 13 and 14 November. On each occasion it was the action of an individual tank that won the day. Female tank 544, commanded by Lieutenant H.W. Hitchcock, was the only one of three tanks to get into action on the 13th and it was soon bogged in a shell hole while Hitchcock was wounded. The original plan was to abandon the tank, which was already surrounded by German infantry, but when Hitchcock was hit again, and two other men wounded, second-in-command Corporal Taffs took over. Assisted by Lance-Corporal Bevan, Taffs now got the tank re-started, reversed out of the hole and set a new course for his objective. Arriving at the German second line, the tank broke through the roof of a dugout and ended up, partly on its side and incapable of moving further. Unable to use his machine guns effectively with the tank at such an angle and attacked by the Germans with machine guns and grenades from all

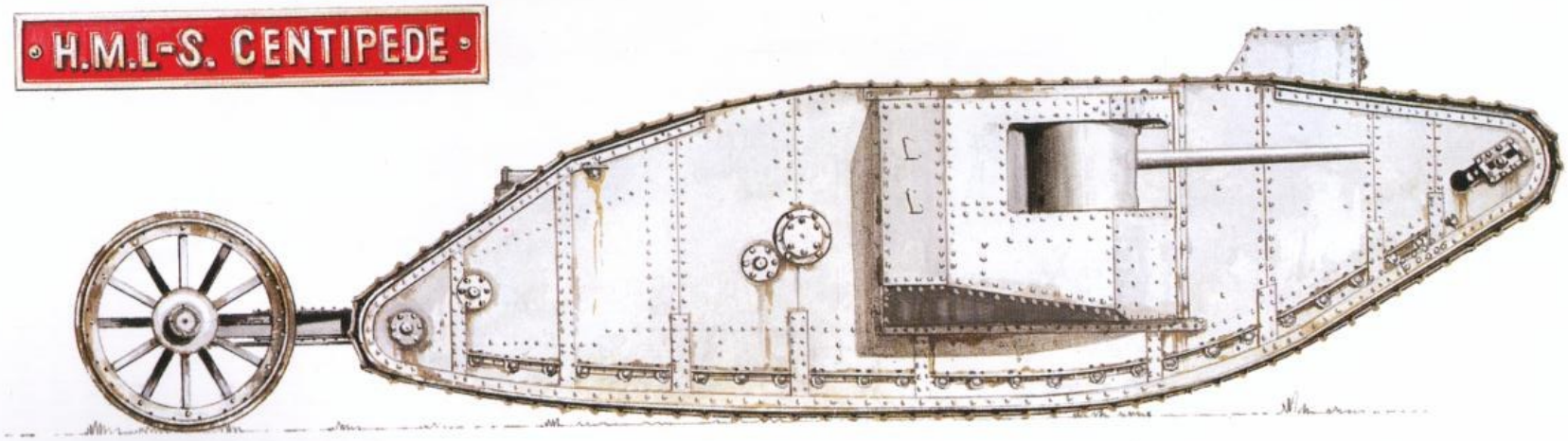
A1: *Number One Lincoln Machine* in the yard of Foster's Wellington Foundry in Lincoln

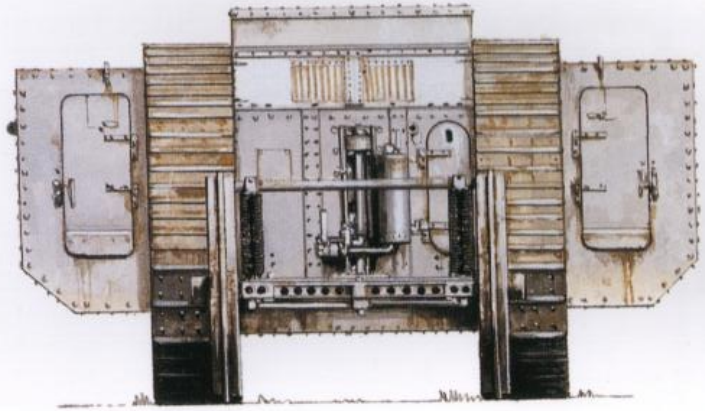


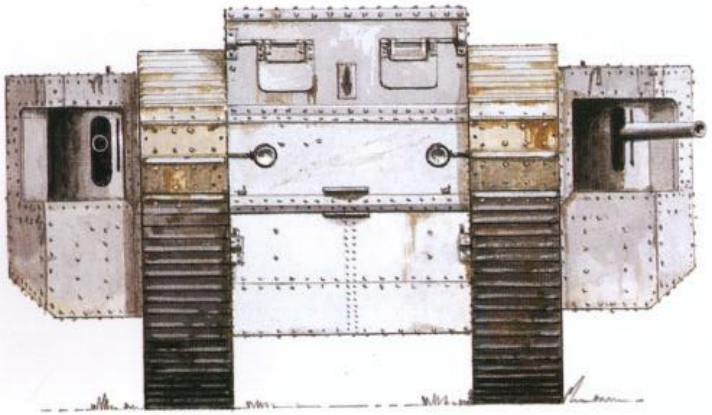
A2: *Little Willie* during trials in Burton Park, Lincoln



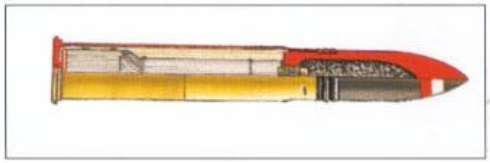
B: His Majesty's Land Ship *Centipede*; otherwise *Big Willie* or *Mother*

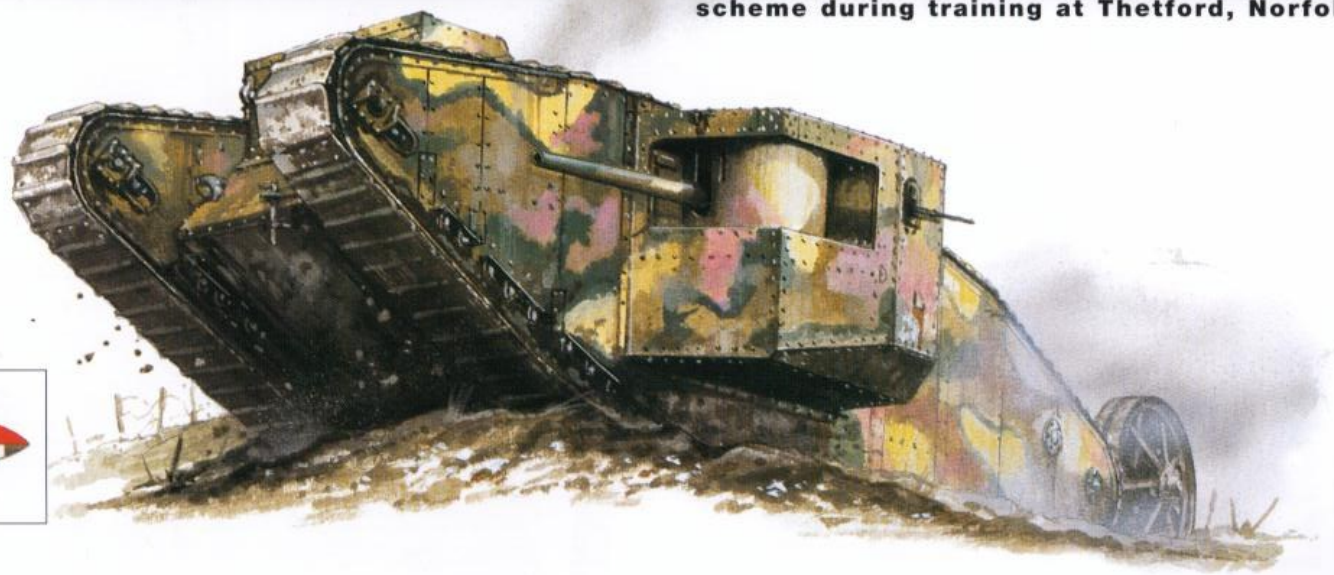






C1: A Mark I (Male) tank in the original camouflage scheme during training at Thetford, Norfolk





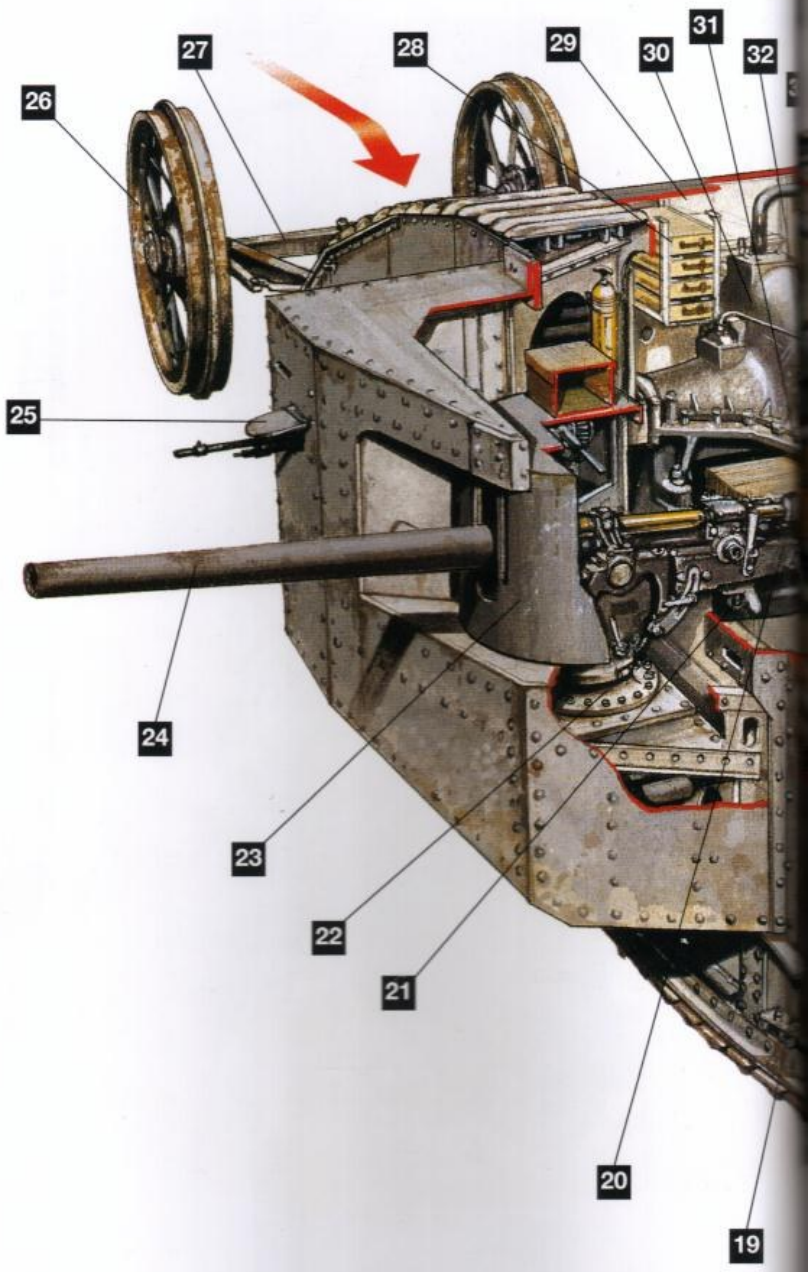
C2: Mark I (Female) tank A11, His Majesty's Landship *We're All In It*, of A Company, Heavy Section, Machine Gun Corps; Somme area, France, November 1916

D: MARK I MALE TANK, NO. 742, IN ORIGINAL CONDITION

(tank D7 of No. 2 Section, D Company, Heavy Section Machine Gun Corps commanded by Lieutenant A. J. Enoch at Flers, 15 September 1916)

KEY

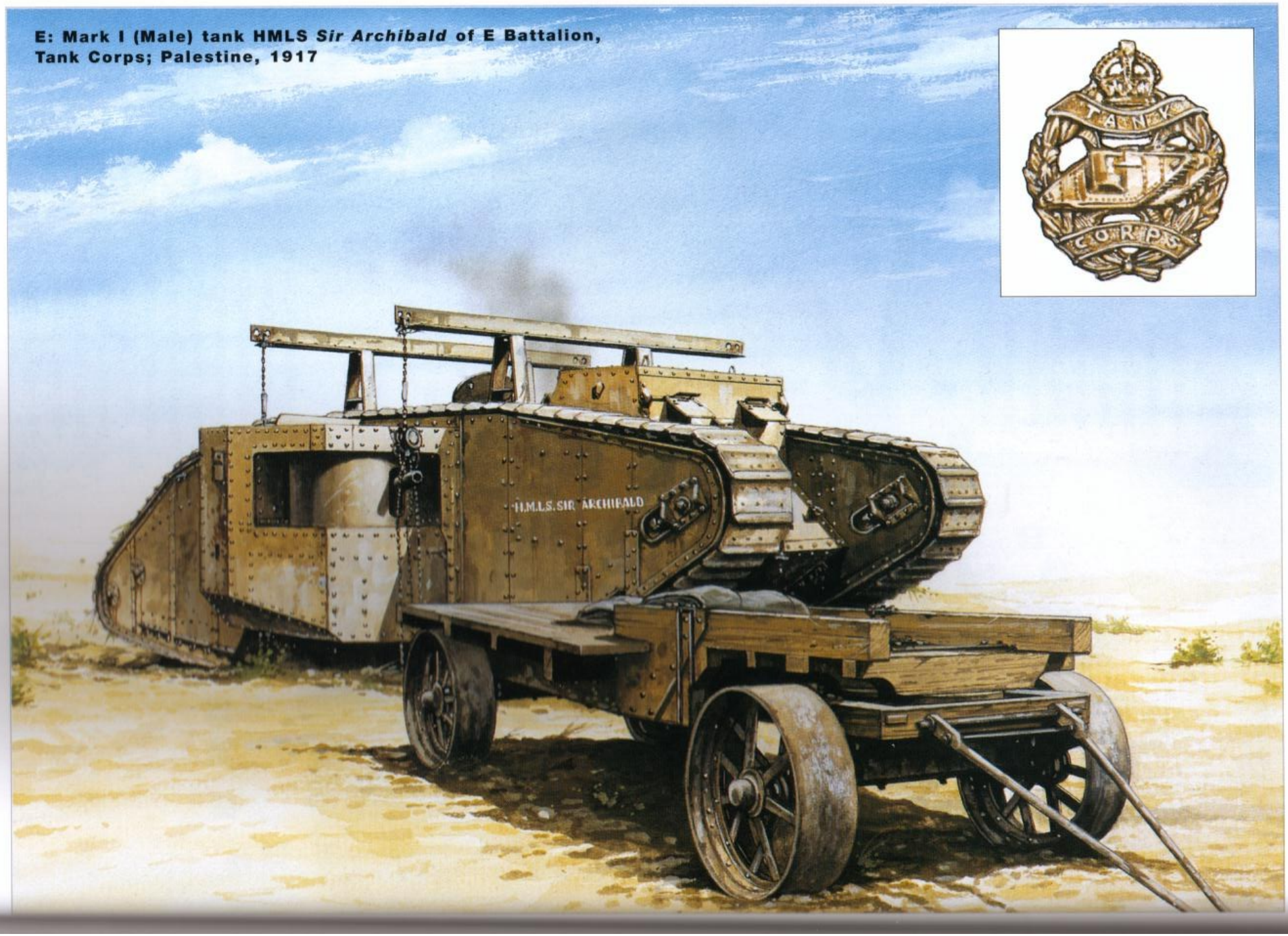
1 Commander's vision slit
2 Commander's small visor flap
3 Commander's main visor flap
4 Port side 6-pdr gun
5 Front machine-gun aperture
6 Steering brake levers
7 Commander's seat
8 Primary gear lever
9 Steering wheel (for tail)
10 Starter chain sprocket
11 Driver's seat
12 Clutch hand lever
13 Track tension adjuster
14 Engine controls
15 Starboard petrol tank
16 Track roller, smooth type
17 Track roller, flanged type
18 External butt strap
19 Ammunition stowage tubes
20 Gunner's sighting telescope
21 Trigger mechanism
22 Main armament pedestal
23 Rotating gun shield
24 Starboard 6-pdr gun barrel
25 Sponson machine-gun position
26 Steering tail wheel
27 Tail frame
28 Machine-gun ammunition stowage
29 Radiator
30 Differential driving axle
31 Primary gearbox cover
32 Engine starting handle
33 Engine oil tank
34 Return coolant pipe
35 Engine governor
36 Reserve ammunition stowage
37 Daimler 105hp engine
38 Secondary gearbox, port side
39 Engine exhaust stack
40 Exhaust outlet baffle
41 Differential locking lever
42 Engine cover
43 Ready-use ammunition stowage
44 Port 6-pdr breech assembly
45 Port side sponson roof



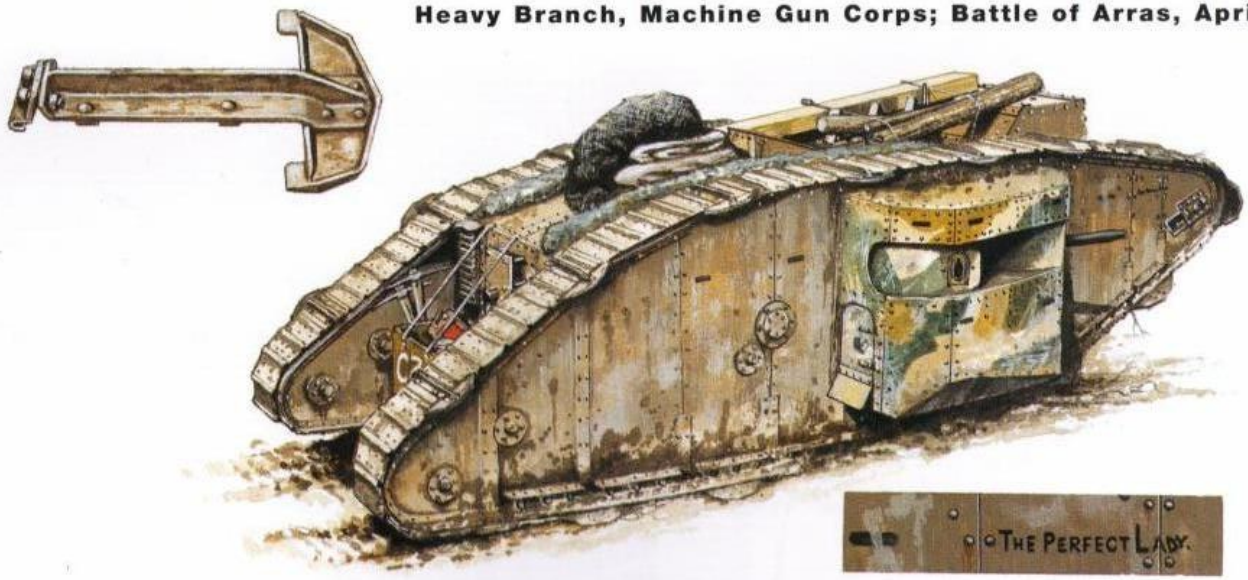
SPECIFICATION

Crew: eight
Weight: 28,448kg
Power to weight ratio: 3.7bhp/ton (imp)
Overall length (including tail assembly: 9.906m
Overall width: 4.185m
Overall height: 2.43m
Engine: Daimler/Knight sleeve valve, watercooled straight six 105hp @ 1,000rpm
Transmission: two-speed and reverse primary box with secondary two-speed selectors on the output shafts

Fuel capacity: 227.3 litres
Max. speed: 5.95km/h
Radius of action: 37.9km
Fuel consumption: 5.9 litres/km
Ground pressure: 12.6/74.8kg/sq.cm
Trench crossing capability: 3.5m
Armament: Two 6-pdr (57mm) 40 calibre, quick-firing and four 7.62mm Hotchkiss air-cooled machine guns
Ammunition: solid shot & high explosive
Muzzle velocity: 554mps
Max. range: 6,858m
Ammunition stowage: 332 6-pdr, 6,272mg


E: Mark I (Male) tank HMLS *Sir Archibald* of E Battalion,
Tank Corps; Palestine, 1917
TANK
CORPS
H.M.L.S. SIR ARCHIBALD

F1: Mark II (Female) tank C21 *The Perfect Lady* of C Company, Heavy Branch, Machine Gun Corps; Battle of Arras, April 1917



F2: Mark III (Male) training tank; Bovington Camp, Dorset, 1917

G1: Mark I supply tank *Dodo* of B Battalion, Heavy Branch, Machine Gun Corps; Messines, 7 June 1917

G2: Mark I (Female) wireless tank; Neuve Eglise, France, June 1917

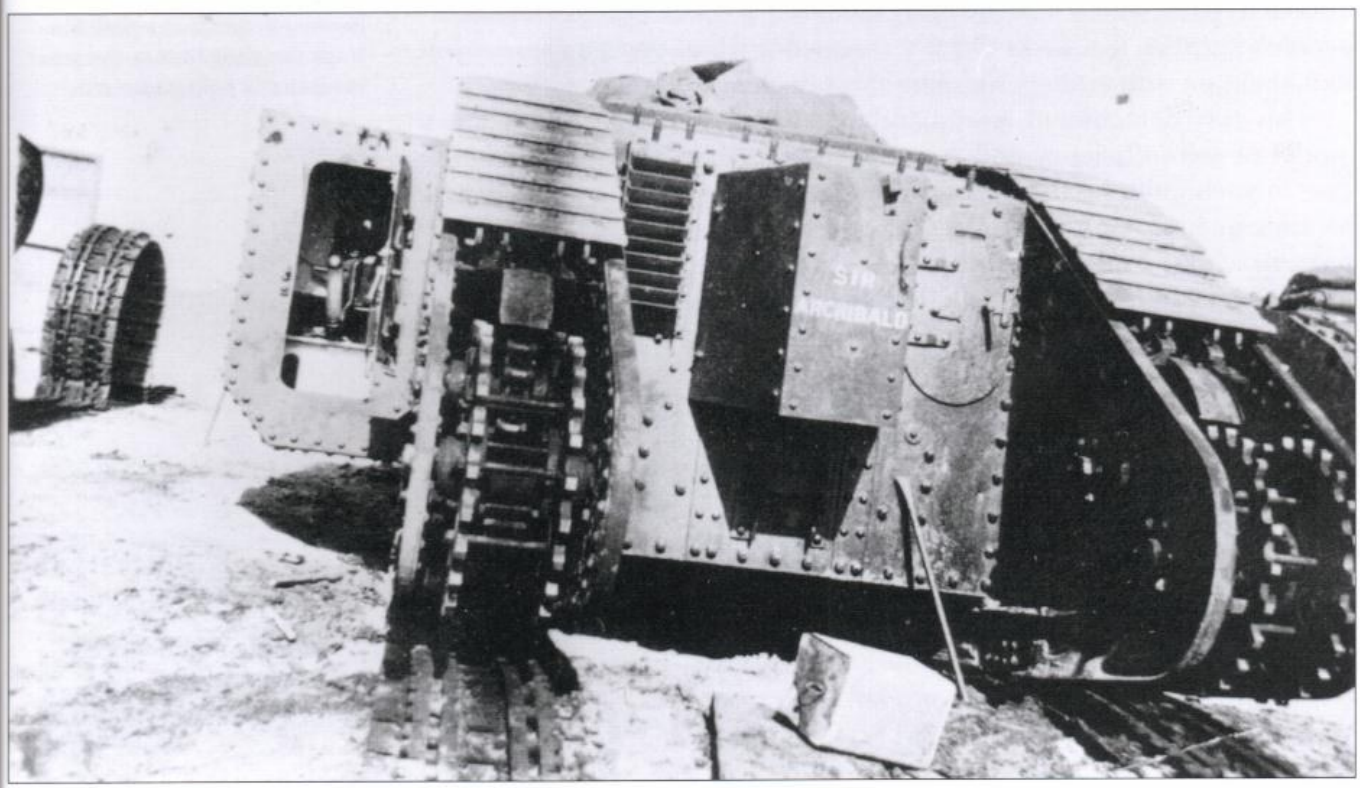
sides, Taffs managed to send off a pigeon, as a result of which, about an hour later, the trapped men were rescued by the infantry; all surviving members of the crew were awarded the Military Medal.

On the 14th success was only achieved by the incredible courage of the Heavy Branch Intelligence Officer, Captain Frederick Hotblack, who guided a tank into action over dreadful ground, under fire, by walking all the way to the objective in front of it! If these remarkable actions prove nothing else they show how quickly the tank men gained a pride in their new arm and the courage that went with it. Even so the stock of serviceable tanks from the first batch had now virtually run out. B Company, which also came out in September, had no tanks at all until a few surviving Mark Is were made available for training in January 1917.

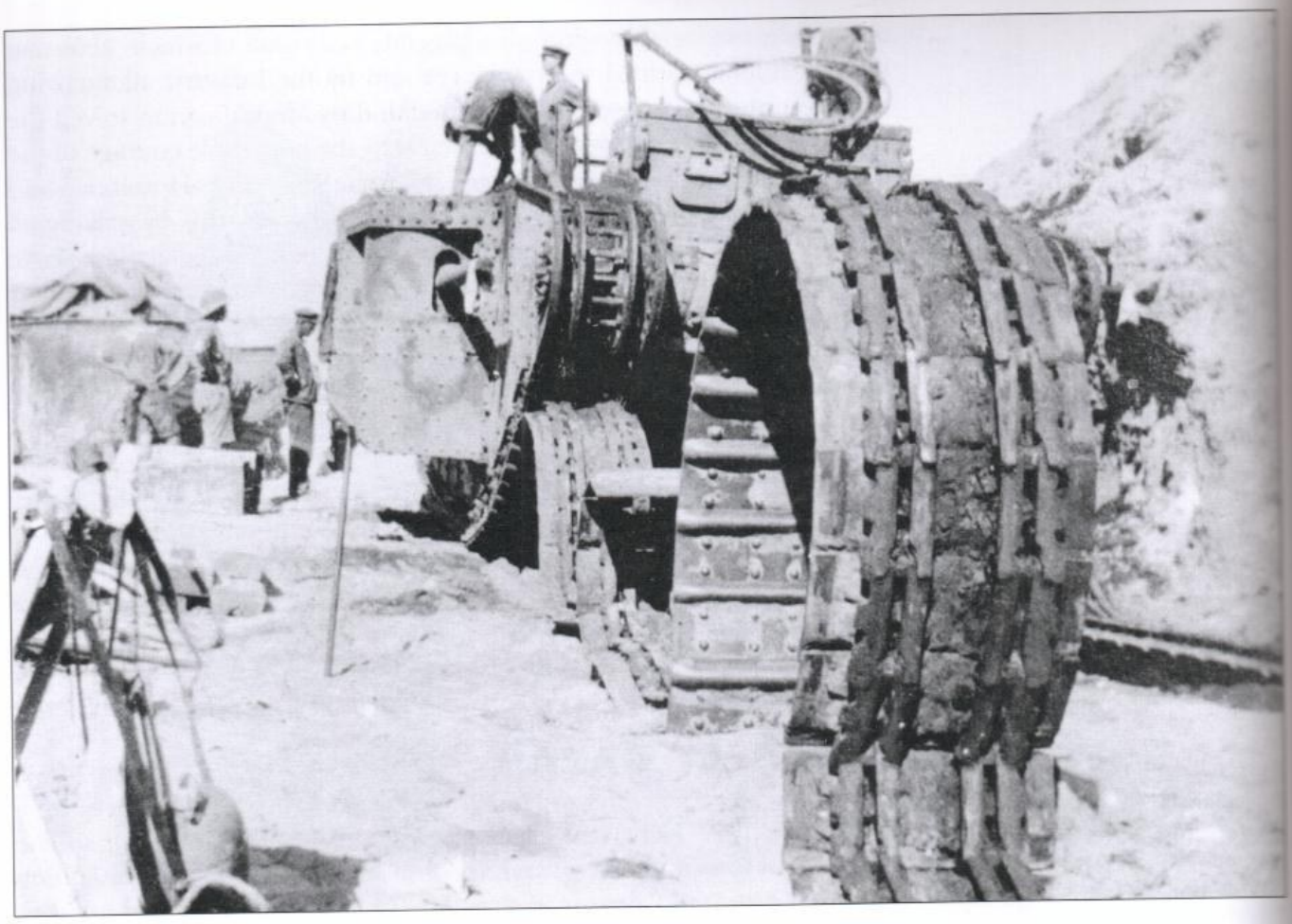
The new tank order from Haig posed two immediate problems. It meant a considerable expansion of what had now become the Heavy Branch, Machine Gun Corps, and more tanks would be needed on which to train the new crews. It was also clear that more space would be required for men and tanks to train. This last problem was solved by opening up a large camp north of Wool in Dorset, centred upon Bovington Farm. At the same time 100 extra tanks were ordered for training.

TANKS AT GAZA

In January 1917 eight tanks from Bovington were shipped out to the Middle East to join the Egyptian Expeditionary Force which was intending to move north into Palestine against the Turks. The tanks arrived in Egypt and followed the army which, by March, was attempting to attack Turkish positions around the ancient city of Gaza. When the battle was resumed in April some of the tanks took part, but with only modest success; a number



A marvellous rear view of *Sir Archibald* in Palestine showing the drive sprockets and a view in through the sponson door. None of the tanks in Palestine had tails but in this case the shield that covered the hydraulic jack has been retained for some reason.



This front view of a Mark I undergoing maintenance in Palestine provides an excellent view of the idlers and track details. Notice that where the track joins the frames the inner flanges still hold it in place.

were wrecked. Inevitably senior officers in the area assumed that they knew much more about how tanks should be used than any of the young officers that served with them and, as a consequence, misused them. The tanks worked in pairs, widely separated, and suffered accordingly. Much to many people's surprise the Turks did not always flee when tanks appeared but took them on with artillery with inevitable results.

This tiny detachment, commanded by Major Norman Nutt, was a model of self-sufficiency and it was also innovative, which is often the case in such circumstances. Individual tanks were modified in a variety of ways to improve protection, either using palm logs or spare track links, or with the means to carry more stores on the tanks. This was done by adding upright pieces of angle iron to the top, which formed a kind of basket for the stores. Unfortunately these loose items moved about as the tank tackled obstacles and sometimes things would fall across the exhaust outlets and catch fire. Sand got in everywhere, just like the mud in France, but the abrasive effect was much more damaging. At least one tank was photographed with improvised shields of light steel on either side of the cab, obviously intended to deflect the stuff away from vital areas.

In Britain tanks went back to the factories for modification before being delivered to Bovington, where an intensive training programme was soon in full swing. Meanwhile the Heavy Branch had established a Central Workshop in France to prepare new machines for active service and maintain old ones. In November 1916 a number of modifications were introduced. Stronger rollers and improved brakes had already been

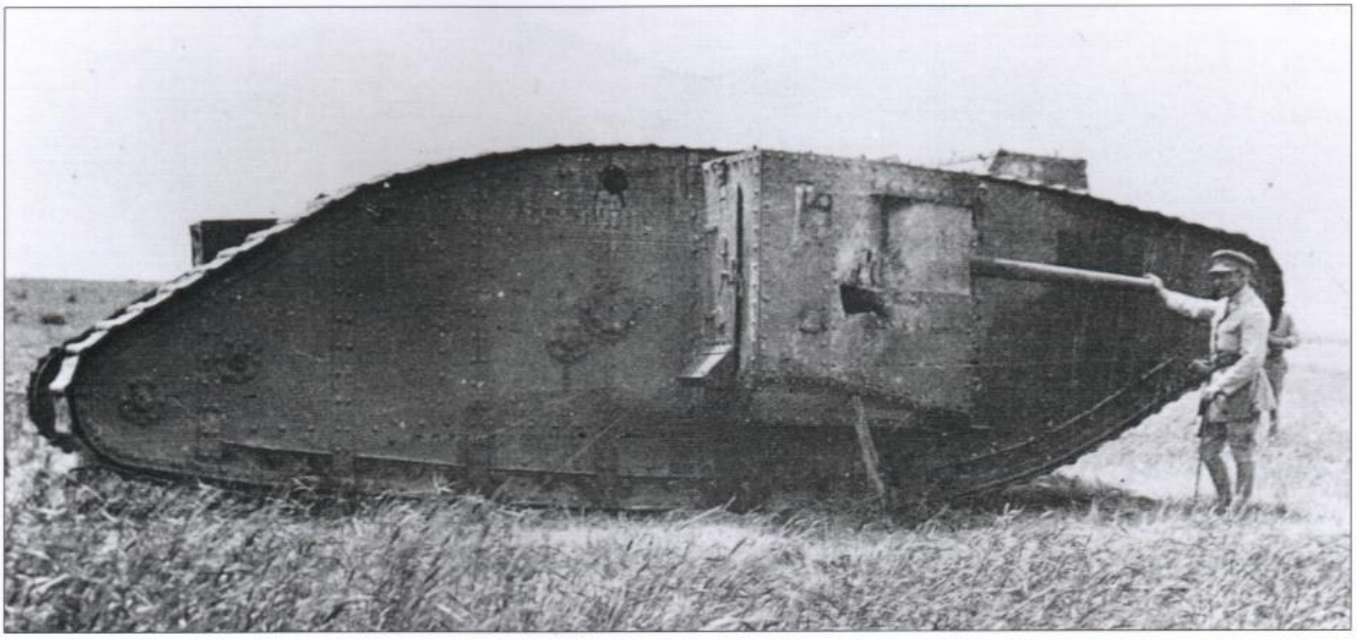
recommended but Central Workshops also went to the length of fitting smooth idler wheels at the front. The old toothed pattern had proved troublesome when the tracks stretched and this modification solved the difficulty.

Those tanks that had survived the 1916 actions were being refurbished for the 1917 campaigning season but it was confidently expected that the new model would be available in time. In the event, when the Battle of Arras began on 8 April 1917, only 15 of the original tanks were fit for action. They had to be supplemented by 19 training machines already in France and 26 more from home to complete C and D Battalions which now formed 1st Tank Brigade (the original companies expanded into battalions in January 1917 to make up new tank brigades of two battalions each).

Expansion of the force meant a new organisation and the original plan would have created battalions with 72 tanks each; that is composed of three companies, each company comprising a headquarters section of four tanks and four fighting sections with five tanks each. [This scheme was never implemented, instead each company in the battalion had three fighting sections, of four tanks each and a reserve section.] Two battalions formed a brigade. None of which made any immediate difference since one company still had no tanks at all.

In the Middle East the five surviving tanks, supplemented by some Mark IV machines to bring the total back up to eight, took part in the Third Battle of Gaza in early November 1917. It was ultimately successful, although each tank involved had up to five different tasks to perform as its part in the battle. Only one tank proved capable of fulfilling them all but the remainder did well enough. There was much greater incidence of track shedding than was known in France. Major Nutt put this down to a build-up of mixed grease and sand, which clogged up the sprockets and threw the track off. Nutt suggested that it might be better to run the tanks without grease but he said that, in that case, the drive sprockets would be better fitted with rollers instead of fixed teeth. In practice it did not matter since tanks were never called upon again in this campaign.

His Majesty's Land Ship *Pincher* serving with Major Nutt's detachment from E Battalion at Gaza. Keeping these old tanks running in a hostile climate, with few spares and inadequate workshop facilities, was a magnificent achievement by any standards.

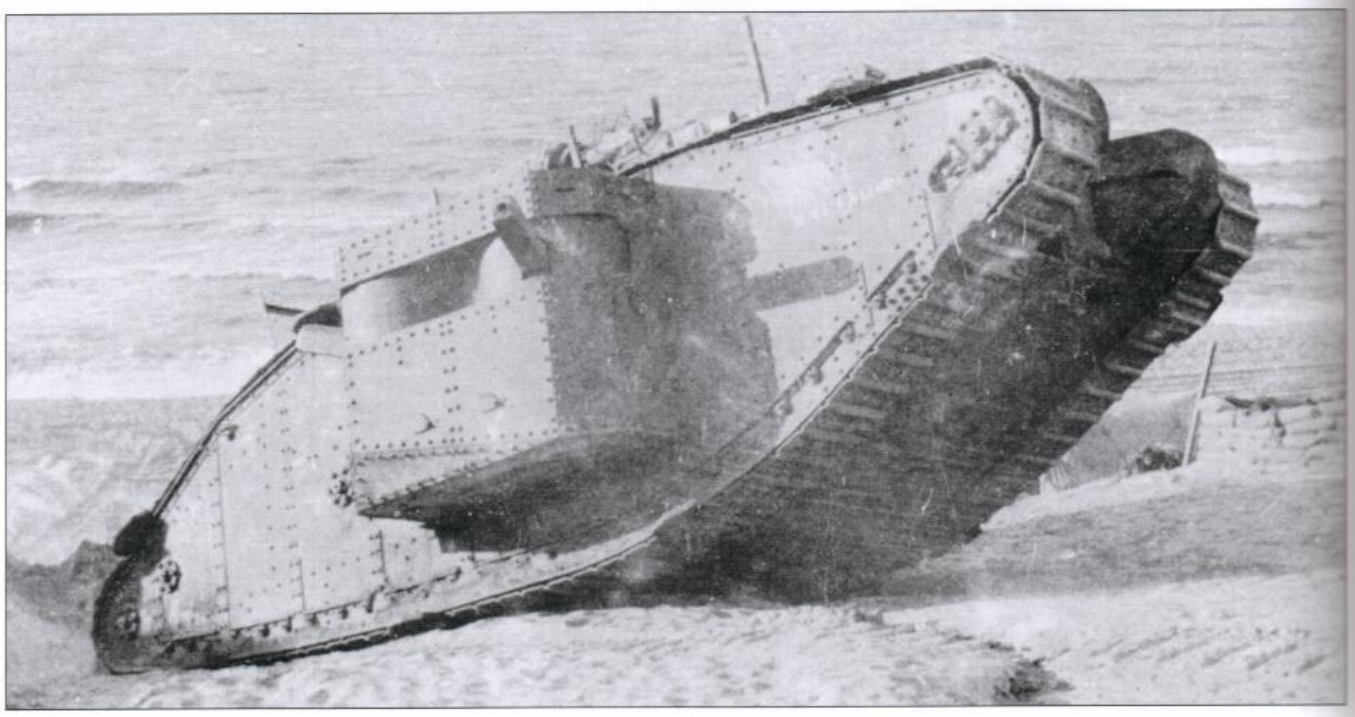


CONVERSIONS AND EXPERIMENTS

With the appearance of later models, the first 150 tanks were designated Mark I and they still had their uses. For the Battle of Messines, which began on 7 June 1917, 12 Mark I and Mark II Male tanks served as supply carriers, having been converted by Central Workshops. The work involved stripping out the guns and their mountings, blanking off the aperture in each sponson and creating extra stowage trays on top. In action the supply tanks went forward in the wake of the fighting tanks to distribute extra ammunition, fuel and grease to tanks that might otherwise have to pull out of action to resupply. A few Females were fitted out as wireless tanks with Morse key sets installed in one sponson and a substantial aerial array rigged on top. The wireless sets were a semi-portable type which had already been employed in the trenches, but they could only be used when the tank halted, turned off its engine and set up the aerial. Thus the idea was that they would stop at strategic locations to act as reporting stations in touch with headquarters.

At least one Mark I Female took part in special sea-wall climbing trials in France in connection with the abortive Operation Hush, the proposed amphibious landing on the Belgian coast. The trials involved fitting special spiked shoes to each track link so that the tank could heave itself, in a series of violent jerks, up the wall and over the lip. Subsequent training would involve Mark IV machines scheduled for the actual assault.

As part of the preparation for what became known as the Second Battle of Cambrai in September 1918 some other tanks were modified. A scheme was devised whereby tanks could cross the dry bed of the incomplete Canal du Nord where it was at its deepest and most impressive, over a causeway formed from three old tanks which had been stripped and strengthened for the task. The only evidence that the tanks concerned were actually Mark I machines is a suspect comment to the effect that they were old Somme veterans, but in any case the



HMLS *Kia-Ora*, one of Nutt's Female tanks. Notice the use of track extenders, the extra panels inside the front horns (presumably to prevent sand being blown back into the cab) and the upright posts on top to keep stores in place.

operation never took place; the three tanks, precursors of the Ark tanks of WW2, all broke down before they could be used.

Finally, mention should be made of a Mark I that was still around in November 1918. Stripped of its sponsons, the tank was equipped with a Westinghouse generator and Portable Tank Crane, mounted on the nose. Hanging from the crane by a chain hoist was an enormous electro-magnet, supplied by the Ingranic Company, and the idea was to use it as a safe method of lifting mines. Trials at Esher, in Surrey, revealed that the device did not work.

It remains to record that the only surviving Mark I, which sadly cannot be identified, was given to Lord Salisbury in 1919 and placed on his Hatfield Park estate to commemorate the events of 1916. Shorn of its original guns, it was fitted with a pair of shorter weapons from a Mark IV which were cosmetically extended when the tank was finally passed to the Tank Museum in 1970.

THE MARK II

Male tanks: 776–800
Female tanks: 576–600

General Haig's demand for 1,000 new tanks and the problems that presented have already been mentioned. There was an immediate requirement for extra tanks on which to train the crews for this new tank army and this was resolved by ordering 100 interim machines. Since they were only required for training it was agreed that there was no need to

A poor but rare photo of a Female tank, fitted with special climbing spuds, tackling a mock sea wall during training for Operation Hush. This climb must have been a driver's nightmare. Had the operation gone ahead Mark IV tanks would have been employed.

The converted Mark I mine-lifting tank photographed at Dollis Hill, London, in 1918. The Portable Tank Crane was mounted on the nose, and the huge electro-magnet is seen gingerly lifting a shell. Presumably this could only be done by a soldier operating the chain hoist from the ground, which seems very risky.

subject them to the full armouring process – they would be assembled from mild steel, or boilerplate. However, at the same time it made sense to try out a number of new ideas, only matters of detail but significant nevertheless. The tanks would be built in two batches of 50, each batch subdivided equally into 25 Male and 25 Female examples. The first 50 would be designated Mark II. Deliveries had begun by December 1916 when nine of the new training tanks were recorded as being at Bovington.

The 25 Male tanks came from Fosters, the Females from Metropolitan. Outwardly they are difficult to distinguish from the Mark I, having the same hull form and sponsons, but there are noticeable details. For a start the new tanks had slightly narrower cabs – in order to allow for wider tracks – which resulted in an uneven arrangement of rivets along the top. Track adjustment was increased by 1.5in. (38mm), which resulted in a different shape for the apertures on the front horns. Most significant of all, however, was a fixture, not unlike the cover of a traditional cheese dish, which replaced the manhole hatch on top of the hull. Sloping forwards, with a large, hinged lid and protected loopholes at the sides it provided an observer with a means of looking out from an elevated position in relative safety, and was also an extra means of escape for the crew.

The idea of steering tail wheels having been abandoned, the hydraulic jack went too, leaving the area between the rear horns looking decidedly bare. Despite the fact that these tanks were unarmoured the principle of improved protection was under constant review. Various experiments with so-called burster plates had been conducted and the idea of bolting additional plates directly to the sides of the hull was considered for the

Mark II. In the event this was never done but the completed tanks all had the extra holes, filled with bolts.

As training tanks, the Mark II machines were unlikely to make a great impact upon history but in fact five of them were earmarked for a highly significant purpose. Even from the start it was clear to most people that a tank which required four people to drive it was hardly ideal. Walter Wilson understood this better than most, and even had a more practical system in mind. Albert Stern, who was responsible for tank supply, was unable to appreciate Wilson's genius so he set an open competition for anyone who could come up with a better system. Five tanks were diverted from the Metropolitan production line and issued, without sponsons or even such fittings as visors, to the competing firms.

One of the tanks seems to have gone to France to be fitted with the St Chamond petrol-electric transmission but it was not ready for testing in time. The other four were remarkably varied. One was fitted with a simple epicyclic final drive devised by Walter Wilson, another used a hydraulic system manufactured by the Williams-Janney Company, while British Westinghouse produced a petrol-electric drive as used in tramcars. Finally, a designer by the name of Wilkins offered a dual gearbox system that looked extremely complicated and, in the event, failed to compete.

The trial took place on 3 March 1917 at the Oldbury Testing Ground in Birmingham. Only three of the Mark IIs took part but they were joined by the prototype tank *Mother* now fitted with a Daimler petrol-electric drive train. The result, which should have been a foregone conclusion, was an outright win for Wilson's design which incorporated a simple but effective epicyclic arrangement in place of the secondary gears. Subsequently one of the trial tanks was altered again, with the addition of a Lanchester gearbox, but precise details have not survived. Surviving records show that this tank was also fitted with a Ricardo 150hp engine.

Experimental machine 209, one of the Oldbury Trials tanks, crossing a trench at Dollis Hill. The broad coloured stripe served to identify competing machines. The five Mark II tanks all ran without sponsons and many other detail fittings were not attached.

THE BATTLE OF ARRAS

As already recorded, 26 Mark II tanks were despatched in a hurry to France to participate in the Arras battle in April 1917. It was a desperate move since, at close range, they were even vulnerable to machine-gun fire but there was no alternative. Photographic evidence suggests that the Females amongst them were fitted with sponsons from Mark I tanks since these can be seen to be camouflage painted while the rest of the tank was not. Bearing in mind the covering of mud which soon plastered itself all over the tanks the authorities had agreed not to waste time and paint on such decoration and, from January 1917, had all new tanks painted all over in a muddy shade of khaki brown.

The change of sponsons, which appears to have been limited to Female tanks only, at least rendered some part of these tanks armoured, but there had been another change. Over the winter of 1916/17 an officer with experience of machine guns convinced the War Office that the air-cooled Lewis gun would make a far better weapon for tanks than either the big Vickers, or the secondary Hotchkiss. Central Workshops in France record converting 62 tanks – both Male and Female – to accept the Lewis gun.

Returns from the battalions which operated tanks in the period from 9 April to 3 May 1917, show that 60 machines saw action: 25 Mark II Males and 20 Mark II Females, along with 15 of the old Mark I pattern (seven Males and eight Females). The five missing Mark II Females from the batch of 50 would be those that were converted for use in the Oldbury transmission trials. Another feature typical of the tanks at Arras was a track extension plate, which bolted onto the original link and spread the weight pending the arrival of wider tracks. They appear to have been attached to every sixth track plate in most cases but there were endless variations. Yet another local modification was an open stowage box, attached to the back of the hull, between the horns, in the space where the tail would have been.

The series of battles known to history as Arras and Bullecourt were affected by three factors. First was the German withdrawal from their old front line to formidable new positions, which the Allies called the Hindenburg Line. This caused the British command to revise its plans. Secondly, as on the Somme, tanks were separated into small groups to attack specific targets which inevitably led to a patchwork of success and

The only known view of a Mark I at Arras, 2nd Lieutenant Tarbet's C6 (No. 752) ditched close to the Blangy Road. Shorn of its tail and fitted with track extension plates it can only be identified by the shape of the track adjustment recess which is more rounded than on the Mark II.

***Iron Duke*, a Mark II Male, makes its way through Arras displaying well the track extenders, V-shaped exhaust baffles and new style of roof top hatch. Notice how mud smears the lower extremities of the sponson and is piled on top from the action of the tracks.**

failure with most of the groups spread out too far apart to offer mutual support. And third was the weather. A wet spring meant that the ground was still soft in many places and, to give one example, all of the tanks allocated to the Canadians for their historic attack on Vimy Ridge got themselves bogged down long before they could get into action. Further south a few days later snow was the problem.

On 11 April D Battalion supported an Australian attack and for the first time some effort was made to concentrate the tanks. Unfortunately overnight snow reduced visibility and obliterated the white guide tapes so that tanks became lost on the approach route and arrived late. Those that did get into action gave the Germans excellent targets against the snowy ground and it was believed at the time that two tanks were captured intact. There is no doubt that a number of tanks were knocked out within the German lines but whether any were mobile enough to be of any use to their captors is not clear. If, as some claim, the Germans used these tanks to test armour-piercing ammunition, they could not have obtained worse samples. Unarmoured Mark II tanks would hardly keep ordinary rifle bullets out and this seems to have created a false sense of security that the Mark IV would soon disabuse.

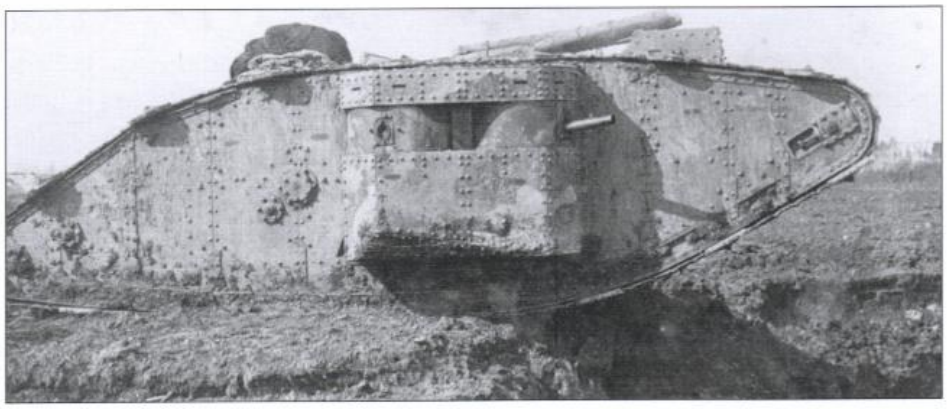
The only recorded modification to a Mark II, apart from those used in the experimental transmission trials, was a supply tank photographed in July 1917 when Queen Mary visited what, by now, had become the Tank Corps at Neuve Eglise. This would be one of the 12 supply tanks already mentioned, but how many of these were Mark Is and how many Mark IIs is not recorded.

After the war one of the Arras veterans was given what might be described as a retro-modification back to the outward semblance of a Mark I, complete with a tail assembly and one Male and one Female sponson, for display purposes in Britain. This tank, now restored to its original form as a Mark II, survives in the Tank Museum collection.

THE MARK III

Male tanks: 801–825
Female tanks: 601–625

The second interim batch of 50 tanks, designated Mark III, was assembled



A Mark II Female, *The Perfect Lady*, at Arras. The camouflaged sponson must have come from a Mark I but it now carries a pair of Lewis guns. It seems that the crew have painted artificial vision slits on the hull and sponson sides. German soldiers were ordered to aim specifically at vision ports.

by Metropolitan. Once again they were unarmoured, in the sense that the plate had not been heat-treated to make it bullet resistant, but on the flanks the plate was now 12mm thick instead of 8mm, to test out another feature scheduled to be introduced on the Mark IV. This made the tank half a ton heavier than the Mark II. Visually they were identical, apart from tiny detail differences on the front of the cab, but the transition to the Lewis gun caught the Mark III at an earlier stage of production, with interesting results.

For a start the cab front of every tank had a larger orifice to accommodate the ball mounting for the Lewis and, more fundamentally, a new style of Female sponson appeared. A meeting in October 1916 decided that, apart from being of thicker plate, the sponsons of the Mark III should be identical to earlier models. This ruling was followed in the case of Male tanks but, although one or two Female Mark IIIs were photographed with the old-style sponson, the majority carried a much smaller structure which only occupied the upper half of the opening in the hull side. Being a much lighter weapon, the Lewis did not require such a

Queen Mary gazes into the blanked-off sponson of a Mark II supply tank. This is a good point to examine the rivet pattern along the top of the cab, which is a distinguishing feature of Mark II and III machines. This inspection took place at Neuve Eglise in the summer of 1917.

large sponson and the gunners worked on their feet, if not exactly upright. The entire arrangement was much simpler; it still enabled the two guns to sweep a considerable arc of fire and crew escape facilities were vastly improved. The lower half of the opening was filled with two large doors, flush with the side of the tank and opening outwards from the centre, which could be kicked open in a hurry, enabling members of the crew to roll out very quickly if the tank took fire.

One source claims that 50 training tanks went to France and 50 remained in Britain, but it is unlikely to have been as neat as that. For one thing we know that 26 tanks from Bovington were rushed out to France for the Arras battle and these must have been Mark II machines in order to bring the total with those already in France up to 45. This in turn suggests that the 50 training tanks at Bovington must have been Mark IIIs, with perhaps a few surviving Mark Is. This may be confirmed by the negative fact that Central Workshop records never mention the Mark III either by title or number.

A few of the Male Mark III tanks photographed at Bovington sported the long 6-pdr guns but the remainder seem to have operated with empty sponsons. This may have been due to a shortage of these weapons, but they were not essential to driver training in any case.

A feature of the training scheme appears to have involved getting the tank stuck in a shell hole or trench and then challenging the crew to get it out. A good deal of digging was often involved although various devices were also tried as an aid to unditching. The most successful, up to this time, seems to have been the torpedo spud, a piece of round timber with a metal collar around its middle which could be bolted to each track and carried round until it provided a purchase upon which the tank could grip. Photographs reveal that this device was carried by some Mark II tanks during the Arras battles.

After the war at least two Mark III Females, with the smaller sponsons, were delivered as souvenir tanks to communities that had raised money for National War Savings Committee schemes. Maidstone and Canterbury both had Mark III machines but they are long gone now.

With the new military settlement of Bovington Camp in the background, a Male Mark III, complete with guns, demonstrates the technique for getting out of a difficult hole. Traces of camouflage along the top of the sponson and on the gun barrel suggest this may have been taken from a redundant Mark I tank.

COLOUR PLATE COMMENTARY

Most Mark III Male tanks photographed at Bovington ran with empty sponsons. From this unusual angle one can see how the sponson door, roof hatch and even the small oval door at the back are all open, no doubt in order to alleviate conditions inside.

A1: *NUMBER ONE LINCOLN MACHINE* IN THE YARD OF FOSTER'S WELLINGTON FOUNDRY IN LINCOLN

Very few people can ever have seen the *Lincoln Machine* like this; for most of the time it would have been shrouded in canvas. Grey seems to be a logical colour for any machine built to Admiralty requirements but it was also applied by most engineering companies as a primer for photographic purposes before new products were finished to customer requirements. The tracks and suspension units, having come from the USA, could well be a different shade. The shape of the turret is known but there is an element of speculation where the gun is concerned; it may well have been a dummy. In every surviving photograph of the complete vehicle, tarpaulin wagon covers obscure the entire turret and upper hull in an attempt to disguise the machine's purpose. These covers would also appear to mask the exhaust outlet and radiator ventilation. The tail assembly is very crude, pivoted to the rear of the hull and held in tension by a single spring attached low down at the back. The machine's mechanical components, engine, transmission and radiator, all derived from the Foster-Daimler heavy artillery tractor, which was also manufactured at the Wellington Foundry.

A2: *LITTLE WILLIE* DURING TRIALS IN BURTON PARK, LINCOLN

In its second form the machine would have been a uniform shade of grey. This rear three-quarter view shows the steering tail assembly and hydraulic lifting device by means of which it could be raised clear of the ground. In later life the vehicle ran without its tail. The turret has now gone, to be replaced by a circular plate. *Little Willie* carried no visible markings, the name and date seen on the vehicle today appear to have been added between the wars. Even so the manufacturers provided a cast plate reading 'Wm. Foster & Co. Ltd. Engineers. Lincoln', which still survives.

Judging from original photographs it would appear that smaller fittings such as the hinged flaps over the front apertures and the moveable covers that protect the weapons ports on either side were only added when the machine was rebuilt. A curious detail concerns the headlamps that were located lower down on *Little Willie*, although the original bolt holes, subsequently filled, can still be seen. The front lamps appear to be electric while the light at the back was probably acetylene. A sample track link is shown, revealing the arrangement on the inner surface.

B: HIS MAJESTY'S LAND SHIP *CENTIPEDE*; OTHERWISE *BIG WILLIE* OR *MOTHER*

The prototype of all rhomboid-shaped tanks also appears to have left Fosters in a coat of grey. The tank was, however, painted white on the underside at the front, including the inner track frames, and this seems to have been done in order to provide observers with a better view of its obstacle crossing capabilities. The method of construction, riveting steel plates to an internal framework, is made more obvious when the rivets

LEFT **A Mark III Female with the old style sponsons training at Bovington. Glancing at the cab front one can see the round hole for a Lewis gun and the way the vision slits have been raised to a point just below the lip of the cab roof. These are two key identification features of the Mark III.**

BELOW **An excellent view of a Mark III Female with the smaller Lewis gun sponson. The escape hatches below the sponson are wide open and the two rotating shields for the machine guns have been turned to face inwards. Notice also the clevises, or hooks, at each end of the sponson for lifting it off.**

are set at boiler-makers' pitch. It would appear that the only permanent machine-gun mounting was located in the front of the cab but it is assumed that the hinged flaps near the rear of each sponson could be temporary firing points.

According to a programme, issued when the machine was first demonstrated, it was constructed of nickel steel plate, 12mm thick on the front of the cab and 10mm at the sides. The sides and rear of the hull were 8mm thick and the roof and belly 6mm. The same programme quoted a rate of fire of between 15 and 20 rounds per minute for the 6-pdr gun and 250 rounds per minute for the Hotchkiss machine gun. Only the nameplate now survives, at the Tank Museum.

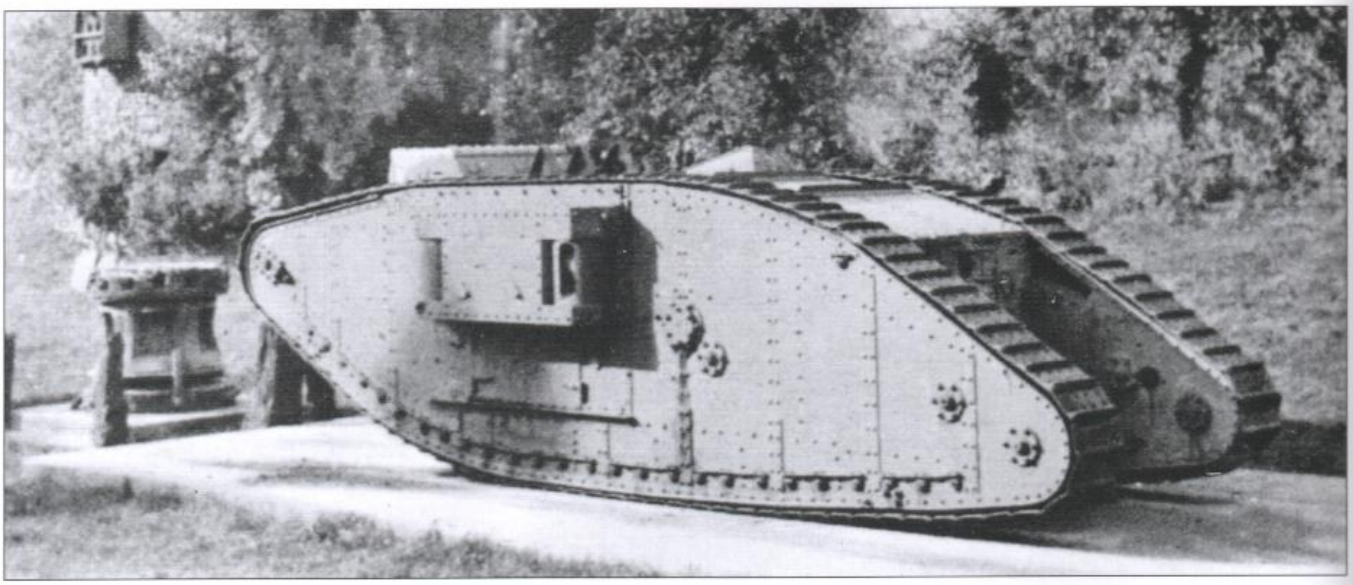
C1: A MARK I (MALE) TANK IN THE ORIGINAL CAMOUFLAGE SCHEME DURING TRAINING AT THETFORD, NORFOLK

A camouflage expert, the artist Solomon J. Solomon, then a lieutenant-colonel of Royal Engineers, was given the task of devising a colour scheme for tanks that would enable them to blend with their background. The colours Solomon chose are said to have included green, brown, yellow and pink, applied in what might be described as an Impressionist style. According to legend he applied the scheme to *Mother* when the tank was at Thetford. Crews training there were then ordered to copy the design on their own tanks, no doubt with varied degrees of success. Solomon's scheme was later declared unsuitable for the Western Front. Colours were not applied to the track plates but these may have been supplied painted in black or dark grey. This would soon have worn off during use and, after running on a hard surface, the raised lips must have been scratched back to bare metal that would have shown up quite brightly from the air when a tank was moving, until they became clogged with mud.

Also shown is a 6-pdr steel shell.

C2: MARK I (FEMALE) TANK A11, HIS MAJESTY'S LANDSHIP *WE'RE ALL IN IT*, OF A COMPANY, HEAVY SECTION, MACHINE GUN CORPS; SOMME AREA, FRANCE, NOVEMBER 1916

Basil Henriques claims that, soon after they arrived in France, crews were instructed to repaint their tanks in a more sober style. Surviving photographs suggest the result was by no means uniform but a typical scheme appears to have involved alternating patches of green, brown and ochre, sometimes outlined in black to create a sort of crazy paving effect. This was more along the lines of a disruptive pattern to

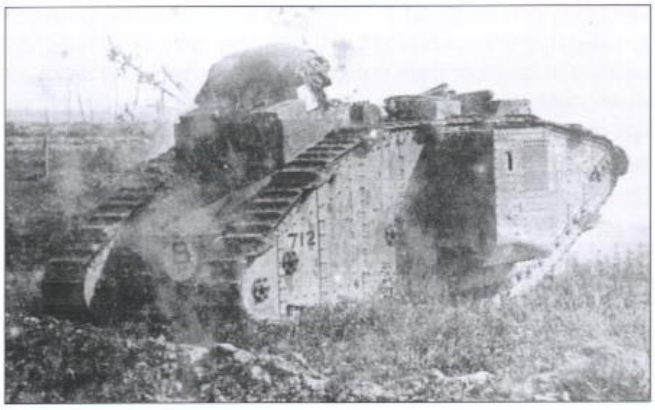


Photographed with other items in the Moat Gardens at Canterbury some time after the war, this Mark III Female was one of at least two of the type that served as souvenir tanks for towns and cities in Britain which had raised appreciable sums in War Bond sales. Most tanks used in this way were Mark IV machines, all but one of which had gone by WW2.

disguise the shape than with the aim of blending with the landscape. Each crew had a letter and number, indicating their place in the company organisation, and invariably also selected a name for their particular tank. These names sometimes followed a theme but were usually frivolous at this early stage, often taking the titles of popular London shows or a play on words such as *A Merry Car* and *Autogofasta*. Some tanks of C Company were named after drinks including *Cognac*, *Chablis*, and *Crème de Menthe* while D Company were more varied with *Daredevil*, *Dinnaken* or *Dracula*. At this stage Heavy Section personnel wore the cap badge of the Machine Gun Corps.

D: MARK I (MALE) TANK, NO. 742, IN ORIGINAL CONDITION

The interior of each tank was painted white, in an effort to improve visibility for the crew, although the floor was covered in black rubber matting. Parts of the engine were in a natural metal finish. Each tank received a number (listed in the text) when it was complete, which remained with it until the end although often obscured by the camouflage. As a security measure tanks also bore the legend 'Handle With Care! – Petrograd' in Cyrillic letters on each side of the hull, sometimes behind the sponsons, sometimes in front. This could be seen on tanks in France, suggesting that not all of them were camouflaged. The tank's number, on a cast plate, was also displayed at the secondary gear position.



Fully stowed Mark I supply tank moving up at Messines. There is a stowage box between the rear horns, another on top and more stores simply dumped on the roof. Notice how the gun position has been filled in and that this tank is fitted with track extenders.

E: MARK I (MALE) TANK HMLS *SIR ARCHIBALD* OF E BATTALION, TANK CORPS; PALESTINE, 1917

No information survives on the colour applied to tanks in Egypt but it seems safe to assume that they were finished in the same khaki brown as armoured cars and other transport. This would soon have faded to a lighter shade while abrasive sand steadily scratched the paint away. Our illustration shows a Male Mark I having a sponson removed. Two steel trestles have been erected on the roof and the gun run back on its cradle. The sponson, once unbolted, would be lifted clear by chain hoists and placed on a special sponson trailer. None of the Mark I tanks that served in Palestine had tails, but there were numerous local modifications, as recorded in the main text. By the time of Third Gaza (November 1917) crews would be wearing the new Tank Corps' cap badge, introduced in July.

F1: MARK II (FEMALE) TANK C21 *THE PERFECT LADY* OF C COMPANY, HEAVY BRANCH, MACHINE GUN CORPS; BATTLE OF ARRAS, APRIL 1917

The tank is finished in overall khaki brown but Female tanks appear to have carried camouflaged sponsons from old Mark I tanks. A new feature, first seen at Arras, was a wooden box marked with the crew number and located

between the rear horns but offset to the left, clear of the small back door. This was boldly marked with the crew number in white, presumably for the benefit of accompanying infantry and other tanks.

Pending the arrival of wider tracks, special bolt-on extension pieces were provided, and for a long time it was believed that these were a feature peculiar to the Mark II. In fact they could be fitted to any tank, at least up to the Mark IV, and were certainly still in use at the Battle of Cambrai in November 1917. They would be clamped to individual track plates and had two functions. The more obvious was a reduction in ground pressure but they also provided a raised lip to the plate, which could provide additional grip in certain conditions. Even so they were a mixed blessing since they might twist a track plate out of shape and must have been extremely difficult to remove after a time.

F2: MARK III (MALE) TRAINING TANK; BOVINGTON CAMP, DORSET, 1917

The training tanks sometimes operated without guns, which were in short supply. Bovington appears to have introduced a system of training numbers which bore no relation at all to the tank's own number. These were painted in white, on each side of the hull ahead of the sponsons, and were quite large. The earliest examples were two digits, later three.

The first people to undergo training were the instructors who then passed on their skills to new tank crews. Training involved basic driving and maintenance and then graduated to tactical exercises on a network of trenches on the Bovington ranges. For officers there were extra courses in compass and map reading along with the technique of using white tape to set out approach routes. Drivers received extensive training in trench crossing and in extracting their tanks if they got stuck. Much of this involved hard work with a spade although a number of special devices were tested to assist this process. One such was the torpedo spud, a short piece of rounded wood, attached to the track by collar and chain to provide a purchase.

G1: MARK I SUPPLY TANK *DODO* OF B BATTALION, HEAVY BRANCH, MACHINE GUN CORPS; MESSINES, 7 JUNE 1917

To convert these tanks, the guns, shields and mountings were removed and the aperture in each sponson was plated over in mild steel. The space created in the interior could then be used for storage, with loading being done through the sponson doors. Trays for carrying more stores were provided on top of the hull and between the horns at the back. Inside the tank wire screens are said to have been fitted to prevent stores from falling against the engine or into crew spaces. One supply tank was capable of carrying sufficient stores to resupply five fighting tanks in the field.

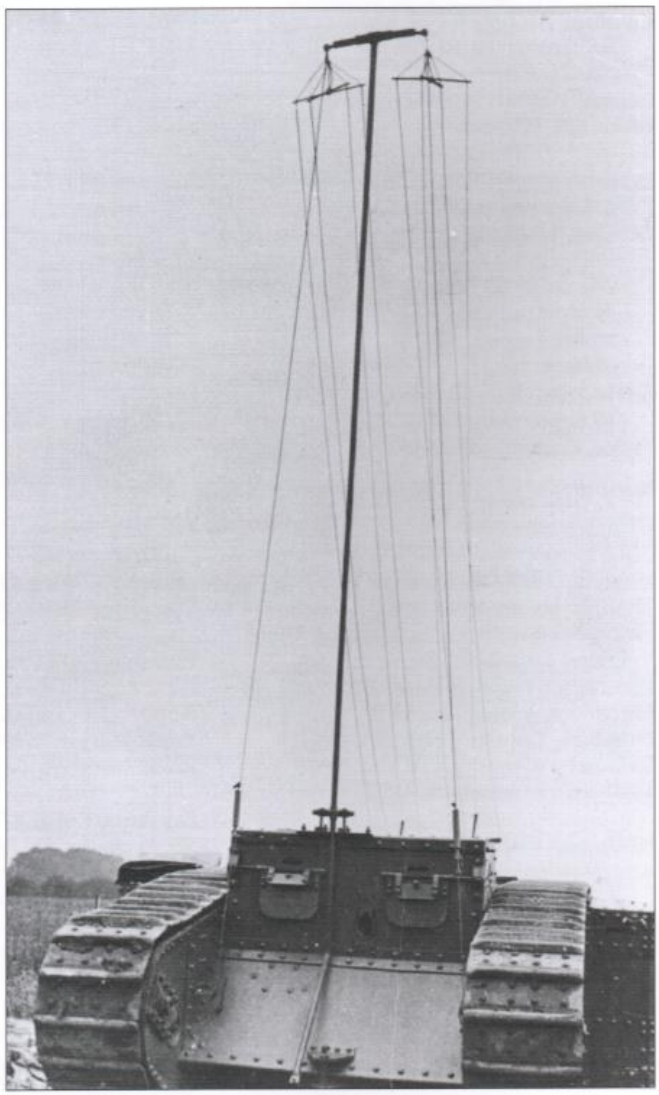
Supply tanks would require a crew of four to manipulate the controls, and for defensive purposes a single Lewis machine gun was mounted in the front of the cab.

F Battalion also received six supply tanks when it drew its equipment in June 1917 and these were issued on the basis of two per company, forming a separate supply section within each company. Two of this battalion's tanks were named *Fill Up* and *Follow the Crowd*. Before the Battle of Cambrai supply tanks were removed from company control and placed under the battalion.

G2: MARK I (FEMALE) WIRELESS TANK; NEUVE EGLISE, FRANCE, JUNE 1917

A portable, Morse key operated set was installed in one sponson while the other was fitted out as a cramped office. In order to transmit, the tank had to halt and erect a large aerial array, suspended from a tall mast attached to the cab. The only known photographs show a Mark I in this form but wireless tanks were not recorded in action until later in 1917 and a number were fielded during the Cambrai battle. Whether these were all redundant Mark I tanks is not clear.

The equipment employed was the Trench Set Mark III, a 50 watt transmitter with a range up to 6,400m (7,000 yards) operating on a wavelength of 350–550m; the receiver worked on 200–500m. Wireless tanks were provided with two extra 10-volt accumulator batteries and the aerial, which was between 60 and 80 yards (54–73m) long, was supported by a 15ft (4.5m) mast linked to an earth net. Although they appear to have worked perfectly well, crews complained that wireless tanks were not made much use of in the field.



A Mark I wireless tank, a converted Female machine, with its aerial array rigged. Notice the opening in the side of the sponson. Wireless tanks continued to be used throughout the war but whether they were all Mark Is is not clear.

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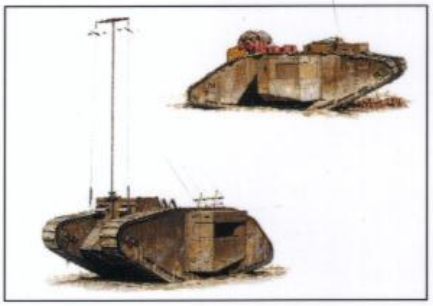

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